WEAPONS AND TACTICS OF THE SOVIET ARMY

Fully Revised Edition

David C. Isby

Would the Soviet Union win a future war against NATO and the United States? This is perhaps the most significant single question in geopolitics today. Much of the answer lies in the strengths and weaknesses of the Soviet Army, since now that they have achieved at least parity in strategic weapons, the Soviets can no longer be deterred by the nuclear umbrella alone. Tallies of tanks, divisions and defence roubles give some measure of capability. But more significant still are the quality of individual weapon systems, the way in which they are used, and the skills of the men who use them. This is the information to be found in *Weapons and Tactics of the Soviet Army*.

The first edition of *Weapons and Tactics of the Soviet Army* was published in 1981 and went on to win much critical acclaim. A great deal has changed since then, and this new, revised edition is fully updated.

The war in Afghanistan has led to the Soviet Army being committed to action for longer than it was in the Second World War. How effective have its weapons and tactics proven in Afghanistan, and what changes have been made? In search of the answers to these questions the author visited the Afghan Resistance, going into the field with them. The result is a wealth of information on Soviet combat performance in Afghanistan.

In Europe the capability of the Soviet Army continues to increase. The Soviets now believe that they could fight and win a war without resorting to the use of nuclear weapons. Developments detailed in this edition include:

- the T-80 main battle tank
- SS-21, SS-22 and SS-23, the new generation of surface-to-surface missiles
- the increasing importance of *Spetsnaz*
- the operational manoeuvre group and its threat to NATO
- the emergence of the new Theatre of Operations commands
- the deployment of new chemical weapons
- advanced transport and combat helicopter designs.

In the past the West could rely on countering Soviet numerical superiority with better weapons, manpower, operations and tactics. This new edition shows that, while retaining their numerical superiority, the Soviets have been moving towards greater sophistication in weapons, operations and tactics. As a consequence, the conventional view of the Soviet Army as a massive but mediocre grinding machine is in urgent need of revision.

The second edition of *Weapons and Tactics of the Soviet Army* depicts an army in transition. Combat-tested in Afghanistan, the great build-up of the 1970s behind it, it is coming to grips with the challenges of new technologies while trying to deal with its own weaknesses.

Continued on back flap

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New edition

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JANE'S

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Introduction

"Soviet leadership seeks continued enhancement of its power and prestige, probing at weakness, pausing before strength, but relentlessly pursuing its goals. Specific Soviet objectives include the weakening or demise of NATO and the withdrawal of US forces from Europe."—David Jones, general, Chairman Joint Chiefs of Staff, *Posture Statement*, 1982.

"You ought to ask: Why, what is this, what's the meaning of this?"—David Jones, private, 15th battalion, Royal Welch Fusiliers, *In Parenthesis*, Part IV.

Weapons and Tactics of the Soviet Army is a reference volume on a military subject, which is what Janes's has been publishing since 1898. Since then the nature of war has changed greatly, and a reference book must reflect today's complex realities. This book details the characteristics of the weapons currently in service with the Soviet Army, the tactics with which these weapons are used, the interrelation between weapons and tactics, and how effective each weapon is, how it works, its drawbacks and how it fits into the overall scheme of the Soviet Army. To examine the weapons themselves in isolation from their context would be misleading. Thus the analysis starts at the bottom, with the individual weapon, and works upwards through all levels of tactics, including those that the Soviets would term operations. The increased Soviet emphasis on the operational level of war is reflected in this edition.

Chapters One, Two and Three provide a broad and general overview, showing the larger framework into which the weapons and tactics fit. This book is not a handbook on the Soviet Army – there are already a number of them – but it covers much of the same ground. The format is designed for the reference user, who is advised, if looking for data on a specific weapon, to check also the material at the start of each chapter and, if possible, the chapters on offence and defence. This will give him an insight into its interaction with other weapons. Entries on related weapons can also be helpful.

Change is inevitable, and this revised edition tries to set out how the Soviet Army has changed in 1980–87, and how its actions have made apparent earlier changes. These years have produced a great deal of literature, both in the West and in the Soviet Union, on the Soviet military. The English-language literature is certainly much more extensive than it was a decade ago. This accounts for much of the growth of this book over the first edition, though there still remain large gaps in what has appeared in print. I have tried to cover as much as I can, while making a conscious effort to try and keep the size and price down.

The 1973 Middle East war resulted in a flood of interest in, and information about, Soviet 1960s-era weapons: the T-62, BMP-1, Sagger, RPG-7, ZSU-23-4 and SA-6, among others. Though there has been no shortage of wars—Afghanistan, Lebanon, Iran-Iraq, Ethiopia, Angola, Nicaragua and elsewhere—the weapons and the lessons of these conflicts remain much less studied in the West than those of 1973. Similarly, weapons such as the T-64/72/80, BMP-2, BM-27, 2S4 and many others remain relatively shadowy years after they were introduced.

Since the first edition, new divisions have formed while others have changed type or increased in readiness, even if the basic form of the army, its organisation and its deployment remain unchanged. Unfortunately, the details of these changes have been poorly documented in open sources in the West, so the figures in the order of battle section remain largely those of the late 1970s, updated where possible.

The war in Afghanistan has been the major operational development since the first edition. Each chapter includes details of combat in Afghanistan as it applies to each type of weapons system, and there is a new chapter to put them into the overall context of the war. Yet while the war has been total and all-consuming to the Afghans, it continues to be of limited significance to the Soviet Union, with an effect on the Soviet Army as a whole that remains correspondingly limited.

Accuracy in any work dealing with the Soviet Army of today is relative. A certain amount of the information in this volume will inevitably be incorrect. Other material may be misinformation, disseminated by interested parties in both the East and the West, to mislead people such as myself (the first edition contained at least one choice example of disinformation, now fortunately excised). I have passed on unconfirmed reports whenever I thought that to do so would be valid, accepting that a certain percentage might be wrong. The magic words "probably", "reportedly" and "it has been stated that" must appear frequently in any work on this topic. All statements about specific weapons being in service (and the type of service) and specific numbers of weapons must all be judged as approximate and estimated, as must all statements of

specific weapons effectiveness, dead spaces and their like. Just as it is misleading to compare the characteristics of the 2S1 with those of the M109A3 or Abbot without comparing their different roles, missions and fire-control systems, it is also misleading to compare hit probabilities (which can be computed on paper, by computer, on the Aberdeen Proving Ground Ranges, in action in Sinai, by comparisons with Western systems or, I fear, "fudged" by those who should know better) without considering what goes on behind the weapon.

Limitations of space have meant that arms such as engineers, signals, motor transport, railway troops, radioelectronic combat, intelligence, and pipeline troops have not been treated in the depth they deserve. This must be considered a reflection of the realities of book publishing rather than of any lack of Soviet emphasis on these arms. I chose to concentrate upon the combat weapons. These areas have been treated at greater length than in the first edition.

If any readers have information, source material, corrections, photographs or anything else that might be pertinent to a further revised edition, please send it to me at Jane's Publishing Company Ltd, 238 City Road, London EC1V 2PU.

This book would have been but a shadow of itself without the contributions of many people to the project. My thanks for both editions go to Joseph Backofen, Joseph Balkoski, William Baxter, Alain Dupouy, Edward Ezell, Chris Foss, Terry Gander, Mark Herman, Ian Hogg, Charles Kamps, James Loop, Virginia Mulholland, Anne Marie Shackleton, John Sloan, Larry Williams and Steven Zaloga, who all gave generously of their knowledge and expertise, and who provided invaluable corrections, information and encouragement. I would like to thank the Soviet experts, in both the US and Great Britain, whose comments and inputs on both editions have been greatly appreciated. The illustrations in this volume appear by virtue of the great assistance of *AFV G-Z*, Leon Conjour, EW Communications Inc., the Egyptian Military Attaché, Washington, V. M. Martinova. Manny Milkuhn, *The Marine Corps Gazette, Soldat und Technik, Truppendienst*, Tom Woltjer, Paul Woolf, Charles Yust, Joe Bermudez, Ken Kraft, the Office of the Secretary of Defence, Public Affairs (especially Ed Michalski), John Crawford, Omega Publications Inc, Mohammed Shuaib, Massoud Khalili, Nabi Wardak, Dr Khalid Akram and Sayid Fazle Akbar. Special thanks go to Michael Isby for his efforts in checking and collating technical data.

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For research on Afghanistan I am vastly indebted to the many journalists, doctors and other travellers inside the country who have freely shared the knowledge they have gained out amongst the Hinds and land mines. My greatest debt, however, must be to the Afghans, whose hospitality and willingness to provide information never flagged in Washington or Peshawar, or during my research trips with them in the field. I was left with a great and undying respect for all those on *jihad* and am proud to count many as my friends. If this is anybody's book, it is theirs. Because they are very much on active service, I shall mention by name only the three who have helped me but have since been *shaheed*—Dr S. B. Majrooh of Kabul, *Maulaui* Shafiuallah of Koh-i-Safi and *Muallem* Halam Mutawakhil of Wardak—and let them stand for all those who remain, and who I hope will read the next edition of this book at home in a peaceful Afghanistan.

Finally, I trust my British readers will excuse my comparisons with US Army practice and my use of American military terms throughout. The gap between US and British military language has not closed since, in 1918, my uncle discovered that the Doughboys relieving his battalion did not understand what a Toc Emma, Emma Gee, or a Mills Bomb was.

(Every effort has been made to ensure that the information in this volume was current as of February 1988. However, the normal time lags of intelligence-gathering and publishing mean that a book of this sort can in places be one, two or more years out of date.)

David C. Isby
Washington DC, 1988

Contents

Glossary

armour basis The equivalent thickness in rolled homogeneous steel armour of any armour arrangement. The way to increase armour basis (apart from thickening of the armour) is by increasing the slope of the armour. The slope of the armour modifies its basis against most penetrators by the following amount:

Slope	Increase in basis
10°	101%
20°	106%
30°	115%
40°	130%
45°	140%
50°	155%
55°	174%
60°	200%
70°	290%

avoidance radius A planning figure used to determine the distance an aircraft will have to stay from a particular air-defence weapon if it is to avoid effective fire.
beam width The width of a radar beam. Fire-control radars have a narrow "pencil" beam, while search radars have a broader beam. The narrower beams are difficult to get on a target unless it is first located by another type of radar, but they are harder to jam.
burst radius The distance from the impact of a weapon at which its blast or fragmentation effects are likely to cause effective casualties.
CEP Circular error probability; the mean distance a projectile will be offset from its aiming point at impact. 50% of all projectiles will impact within the radius of the CEP from the aiming point; 90% will impact within 2.5 times the CEP and 99% will impact within 4 times the CEP.
cyclic rate of fire In an automatic weapon, the number of times the mechanism goes through the load-fire-eject cycle in a minute, not taking into account time to aim, reload, or adjust fire. It is a theoretical rather than a practical figure.
dead track AFV track that is not under pressure from its connectors and hence is dead weight, joined together by track pins or end connectors. It is easier to maintain than live track.
desant Cognate of the English "descent", this is an attack delivered outside the actions of a single combined-arms battle with the aim of achieving surprise. *Desants* may be strategic, operational or tactical. They may be inserted by parachute.
effective range For tanks, effective range is the maximum range at which a trained crew under "quasi-combat conditions" will achieve a 50% first-round hit probability against a stationary 2.5m-square target. For direct-fire weapons against armour, effective range is similar. For automatic weapons it is the longest range at which substantial losses are likely to be inflicted on a small-area target.
forward detachment A force with a specific battlefield objective which is deployed forward of the Soviet first echelon.
front Soviet operational formation, usually consisting of three to five armies plus air elements.
gradient The average slope of standard ground that a vehicle can climb. It is basically a comparative figure as in practice gradient depends heavily on type of soil; the T-62's gradient ability can vary from over 60° to less than 20°. River banks – naked and slippery slopes – reduce gradient ability most.
ground pressure The pressure, in kilograms, exerted on the ground by each square centimetre of the vehicle's tracks at combat weight. The lower the ground pressure, the more types of terrain the vehicle can cover.
horsepower All horsepower figures for vehicles are given in brake horsepower, except for helicopters, where the figures are for shaft horsepower.
infantry fighting/combat vehicle A vehicle carrying a squad of infantry that primarily fights while mounted on that vehicle. Normally has gunports for firing while under armour.
intermediate cartridge A cartridge between a rifle and a pistol cartridge in size and power.
live track Track joined together with end connectors so as to be under pressure, like a spring-hinged door. Because of this, live track requires less energy from the drive train to pick it up off the ground, as the springs raise it of its own accord. It normally uses rubber bushings. Live track is obviously more complicated than dead track and so is more difficult to maintain.
maximum range The farthest a projectile will travel. For direct-fire weapons it is normally determined by the maximum sighting distance on the direct-fire sights. For indirect fire it is how far the shell will travel. Some weapons, such as tank guns, may have to be mounted on an incline to reach their maximum indirect-fire range, as the mounts cannot achieve the elevation of comparable field guns.
minimum range The range below which a weapon cannot be guided. It is not the same as the arming distance, which is a safety factor in most missiles and rockets.
mobile group A temporary force assigned an oper-

ational combat mission independent of that of a main Soviet echelon. The operational manoeuvre group is a form of mobile group.

operational manoeuvre group (OMG) A temporary force assigned one operational mission, either independently or in conjunction with other forces, in furtherance of Soviet operational objectives. It can carry out a range of *reydy* or forward detachment missions.

point-blank range The range at which the highest point of the projectile's flightpath does not exceed the height of the target.

probable error deflection (PED) Similar to PER, but dealing with deflection. For rifled artillery it is much smaller than PER.

probable error range (PER) An index of precision of an artillery piece. The smaller the PER, the more accurate the weapon. 50% of a weapon's "overs" (shells that fall beyond the target) and 50% of its "shorts" (shells that fall short of the target) will each be within one PER (for that gun and range) of the mean point of impact. This figure is usually larger in the field than on paper.

probability of hit An estimate of the chances of a shell (or series of smaller projectiles) striking a specific target at a specific range. Most of these figures are taken from field tests or estimated on their results. Crew training and battlefield conditions can modify these results greatly.

probability of kill The US Army divides kills into K-Kills (total destruction of all combat ability), F-Kills (Firepower kills; destruction of the primary weapons systems capability) and M-Kills (Mobility kills; destruction of the ability to move). The probability of kill represents the average chance of achieving one of these. The exact point at which a projectile strikes a target greatly affects the probability of kill.

projectile expenditure rate Soviet term indicating the number of artillery shells to be used in a given time to achieve the desired result against a specific target.

range Where given, range is road range with full fuel and at road march speeds. These figures are for marches on metalled roads. For dirt roads range is about 75% of this figure, and less cross-country.

rate of fire The speed with which a weapon can load, fire and reload. Again it varies widely, depending on training and conditions, which is why it is usually divided into a theoretical maximum (at which the system is fired as quickly as its design allows) and an actual or combat rate of fire, which allows for such human activities as aiming.

reydy Cognate of the English "raid", this is a mobile action which does not include amongst its objectives the holding of terrain.

Sarandoy Internal security troops of the Ministry of the Interior of the DRA, successors to the Gendarmerie.

speed Speeds are normally given as maximum speeds along metalled roads. Speed on dirt roads is about 30–40% below this figure. Cross-country speeds depend greatly on the type of terrain, but usually are about 50% of their maximum road speed for tracked vehicles (although some are as low as 25% of the maximum), and 20% for wheeled vehicles, those with special cross-country mobility features being faster.

Spetsnaz *Spetsial'noye nazmacheniye* (special purpose troops). Special operations forces.

strategic/operational/tactical depth The distance behind the enemy front line at which the outcome of the war, operation or battle will be decided. The strategic depth includes the enemy's homeland and "strategic rear"; operational depth can be up to 200–500km, tactical depth less than that.

trench The width of a trench that the vehicle can cross at a perpendicular angle of approach. Angle and ground can also affect this capability.

trim vane A folding metal plate on the front of a vehicle that gives stability when swimming.

tilt The angle at which a vehicle can "bank" to the side. Also depends heavily on type of soil.

vertical obstacle The size of vertical step that a vehicle can surmount, although this would entail exposing its belly to any enemy position to its front. The effect of vertical obstacles is much worse on slopes. A T-62 cannot surmount a 0.6m step on a 20° slope, so that just a log on a hillside can stop even this powerful tank.

Abbreviations

AFV armoured fighting vehicle; any armoured vehicle
AP armour-piercing (also used with other abbreviations)
APC armoured personnel carrier
APDS armour-piercing discarding-sabot
APFSDS armour-piercing fin-stabilised discarding-sabot
APHE armour-piercing high explosive
ATGM anti-tank guided missile
C capped (used in conjunction with other abbreviations)
cal length of gun in calibre
CIA Central Intelligence Agency of the US Government
DIA Defence Intelligence Agency of the US Department of Defence
DRA Democratic Republic of Afghanistan. The regime in power in Kabul since the *putsch* of April 1978.
ECM electronic countermeasures
EM enlisted men
EW electronic warfare
Frag fragmentation
GHz Gigahertz (thousand Megahertz)
GRU *Glavnoe Razved-Yvatelnoe Upravlenie* (Main Intelligence Directorate of the General Staff)
HE high-explosive
HEAT high-explosive anti-tank
HEP high-explosive plastic
HESH high-explosive squash-head
HV high-velocity (used in conjunction with other abbreviations)
HVAP high-velocity armour-piercing
I incendiary (used in conjunction with other abbreviations)
MHz Megahertz
m/sec metres per second
m/v muzzle velocity
NBC nuclear, biological and chemical
POL petroleum, oil and lubricants
PPS radar pulses per second
PRF pulse-repetition frequency
RAP rocket-assisted projectile
RoF rate of fire
T tracer (used in conjunction with other abbreviations)
Trav traverse
TVD *Teatr Voyennykh Deystivy* (Theatre of Military Operations)
WP white phosphorus

Unit, vehicle and other symbols

Airborne infantry
Air defence
Tank
Chemical
Naval infantry
Engineers
Artillery (towed or SP, weapon type shown at side)
Motorised rifle
Infantry (non-Soviet)
Medical
Anti-tank (any)
Anti-tank artillery
Reconnaissance
Special forces
Rocket or missile artillery
Service support element
Supply installation (fixed)
Signals
SVCS Service support
(–) Unit has had components detached from it
(+) Unit has been reinforced with non-organic assets
HQ Headquarters (while moving)
Headquarters (deployed)
Unit is an ad hoc or mission-specific grouping
Observation post
• Squad or individual vehicle
•• Section (US usage of term)
••• Platoon
I Company or battery
II Battalion
III Regiment
x Brigade
xx Division
xxx Corps

xxxx Army
xxxxx Front
xxxxxx Theatre
Command post
Mortars
SAM launcher (tactical)
ZSU-23-4
Main battle tank
Light tank
Heavy tank
APC or BMP
SP gun
AVLB
Engineer APC
Minefields
—II— Unit boundary (here a battalion)
Unit defensive position (here a platoon)

Light	Medium	Heavy	
			Automatic infantry weapon
			Mortar
			Anti-aircraft machine gun
			Artillery gun or gun/howitzer
			Howitzer
			Anti-tank rocket-launcher
			Anti-tank gun
			Recoilless rifle
			Rocket launcher artillery
			Anti-aircraft gun
			Missile
			Air-defence missile
			Anti-tank missile

Chapter One

The Soviet way of war

"Wars are not won by big armies, but by good ones."

MARSHAL SAXE

Military doctrine

The cornerstone of the Soviet Army is military doctrine, the officially approved system for perceiving and analysing the nature of war, how it will be waged and with what weapons. It is a fundamental statement of first principles which, in the words of Marshal Nikolai Ogarkov, former Chief of Staff, is "a system of guiding principles and scientifically substantiated views of the Communist Party and the Soviet Government on the essence, character, and methods of waging a war . . . as well as the military organisational development and preparation of our armed forces and country. . . ." Doctrine itself flows from many sources: Marxist-Leninist thought, Russian nationalism, and changing military requirements. Military doctrine is determined at the highest level of political leadership: the Politburo and the Party Secretary. Doctrine answers basic questions as to the kind of enemy, war, Soviet forces, Soviet preparation, and means of war at which the resources of party, state and military should be aimed. Though seen as unitary (including all services and activities), empirical and scientific, doctrine is not static and unchangeable. Military doctrine has two components: military–technological and political. The Soviets have no doubt that war is a continuation of politics (which in turn is a continuation of economics). Once doctrine is decided upon, it cannot be questioned except through indirect routes or at the highest levels.

Soviet doctrine has gone through a number of phases since 1945. The 1945–53 Stalinist phase continued the primacy of Second World War-style conventional war; the 1953–59 transitional phase came to grips with the problems of nuclear weapons, leading to the primacy of nuclear warfare, centring on strategic forces, which had emerged in the 1950s. By the mid-1960s the Soviets also incorporated the potential for conventional operations in their doctrine, which today combines the key importance of nuclear weapons with the desire to fight conventionally. The Soviet belief that they had achieved the ability to attain theatre objectives in conventional war was not seen as inconsistent with the continued central importance of nuclear weapons to all aspects of modern war, and probably lay behind the 1981 "no nuclear first use" declaration.

For all the importance the Soviets place upon doctrine, they realise it cannot be translated into reality without proper armament norms and combat effectiveness. This is simply a recognition that any armed forces require weapons in a number and quality sufficient to carry out their mission as imposed by doctrine, and that these weapons must be used effectively or they are so much junk. Subordinated directly to doctrine, the concepts of armament norms and effectiveness prevent doctrine from becoming empty words. This is what happened before 1941, when the Soviets had made advances in thinking at all levels but the troops and weapons needed to realise them were lacking. The Soviets are well aware that, even at the highest levels, weapons and tactics remain the foundation of their strength. The highest level of Soviet military thought aims to understand and follow doctrine and achieve the required armament norms and combat effectiveness. Once that is achieved, all else should follow.

Doctrine must be distinguished from military science and military art. To the Soviets each is a different and precise thing. While doctrine directs the full range and sweep of Soviet military thought, military science is "a system of knowledge concerning the nature, essence, and content of armed conflict." The term science is deliberately chosen. The Russians have long been great believers in fundamental scientific laws (as illustrated, for example, by the work of Dmitri Mendeleyev) and have transferred this to military science. These laws of war may have the character of necessity, but they are not fixed. Because they affect all aspects of life, they are by no means purely military and are the responsibility of the highest level of Soviet leadership. Like any science, it is based on empirical data, which can be gathered either through actual use, manoeuvres, tests and other experiments, or from historical study. According to the late Marshal of the Soviet Union A.A. Grechko, "The value of military history is in the creative perception of the experience and lessons of the past, in the capability to disclose the regular laws of the development of methods for the conduct of war, in its

boundless capability for the expansion of the military world outlook and military thinking of officers and generals." Finding out the nature of war through empirical study is a key part of military science.

The elements of military science include the general theory of military science, the theory of the organisation of the armed forces, military geography and military history, theory of military training, military training and, most important, military art.

Military art is "the theory and practice of combat," and, despite its name, is recognised as a scientific theory. Military art encompasses the theory and practice of combat from the highest to the lowest level, and is divided by its scope into strategic, operational and tactical levels.

As throughout Soviet military thought, the principles of military art for modern war have been in a state of flux. By 1977 the *Soviet Military Encyclopedia* was defining them as:

1 Preparedness for war forces, plans and thinking.
2 Surprise and initiative.
3 Most efficient use of all assets.
4 Co-operation between services and forces.
5 Concentration of forces at the decisive point and time.
6 In-depth operations.
7 Full use of moral–political strength.
8 Strong and direct top-down leadership.
9 Steadfastness and decisiveness in carrying out orders.
10 Surprise and security.
11 Rapid restoration and rebuilding of forces.

Marshal Ogarkov, when he was Chief of the General Staff, stated in 1984 that new weapons technology was fundamentally changing the nature of warfare; but while the nature of the whole of Soviet military art and science was evolving in response to changing technology, the basic elements were likely to endure. His successor, Marshal Akhromeyev, apparently shares this Marxist view of technology as the locomotive of change.

Strategy is the major element of military art. The Soviets do not have different army, air and naval strategies; there is one common strategy for all the services. The integration of the services is seen to be possible only with a single strategy. In wartime, strategy will be planned by the highest levels of Soviet command and will deal with global operations and the grouping of forces to carry out operational missions.

Operational art is the next level of military art. Each service has a different operational art (although they are held together by having the same strategy, military science and, of course, doctrine). It deals with combat by armies and fronts, which are theatre-level forces. A front (equivalent to an army group or army) is the basic operational formation. These will all be integrated into a single command by a TVD (equivalent to a theatre of military action) high command. The re-emergent TVD level of command has its actions governed by the principles of the operational art. Possible Soviet plans for the invasion of Western Europe are examples of strategic-operational planning, and they would only be undertaken in the context of a larger strategic plan.

Tactics govern the action of the military units making up an operational force. Divisions and regiments are considered tactical units; battalions and smaller are tactical sub-units. Operational success is based on the correct application of tactics, much as strategic success is based on the sum of operational results. Each different unit and sub-unit, and each individual weapon system, has its own individual tactics. The Soviets spend a great deal of time in determining the optimum tactics for each and how they should be carried out. To accomplish this, there are many numerical standards, tables and algorithms, stemming from the scientific perception of the military art at all levels. It is easy to be convinced that these numbers represent reality, but all the similiar calculations made before 1914, which appeared equally impressive, proved fallacious. (Examples of this Soviet approach can be seen in the "chance of victory" table in Chapter 7.) Scepticism about this sort of approach is not uncommon in Soviet Army publications. It has been criticised as reflecting neither the importance of political consciousness nor the commander's creativity and skill.

The Soviets believe that all the charts, nomograms and tactical computers cannot substitute for a thorough understanding of both military science and military art. This should be acquired over a lifetime's service, including field command, professional military education and "culture". It is such a background that will allow a commander to decide correctly whether the norms must be filled or are unobtainable goals, or if there are circumstances beyond those of the nomograms.

If empirical research has determined the best way for a unit to act on the battlefield, then all its commander need do is to make sure that it does indeed behave in that way. However, in the words of one writer, "a victory cannot be calculated, it must be won." Despite these reservations, the Soviets retain this empirical outlook and it is a key part of their comprehensive yet highly regimented system.

Laws and principles

The 1977 edition of *The Soviet Military Encyclopedia* offered six basic laws of war to guide formulation of strategy:

1 War is dependent on political goals.
2 War is dependent on economic strength.
3 War is dependent on scientific–technical strength.
4 War is dependent on moral–political strength.

5 War is dependent on military strength.
6 Victory goes to the side that offers and uses the capabilities of a new and more progressive socio-economic order.

These laws restate the Soviet view of war as a clash not simply of armed forces, but of every aspect – social, economic, cultural, political – of the opposing nations, which explains much of the structure of these elements in Soviet life. The resulting militarisation is what Marxism–Leninism requires of a modern state if it is to ensure its survival – and the inevitable triumph of socialism – in a hostile world. It is in terms of these laws – rather than simple totals of ICBMs and divisions – that the Soviets evaluate, at the highest strategic level, the "correlation of forces". This approach also has the advantage, for the Soviets, of looking for strengths to set against their weaknesses, especially in the economic and diplomatic sphere.

The principles of the operational art govern both operational and tactical-level Soviet units on the battlefield. They can be seen as themes that run throughout Soviet operational and tactical thought. The Soviets realise that no set of operational principles can be immutable, for changes in technology and strategy will affect them all or their relative importance. While their precise application may vary, and there are even different sets of principles, Soviet military thought at operational level and, indeed, all levels is guided by:

1 Speed and shock: mobility, manoeuvre and high rates of combat operations.
2 Concentration of effort: decisive superiority at the decisive place at the decisive time.
3 Surprise and security.
4 Combat activeness.
5 Preservation of combat effectiveness.
6 Conformity of the goal.
7 Co-ordination of forces.

Only the offensive will yield victory; the principle of speed, shock and manoeuvre is the decisive component of the offensive. On the nuclear battlefield it may be the best defence against nuclear targeting. The Soviets insist on maintaining the momentum of the offensive. Even if nuclear weapons are not used to defeat the enemy, surprise, suppressive fire, bypassing or outflanking resistance and a greater emphasis on "deep thrusts" will contribute to the speed, shock and manoeuvre. The Soviets realise that speed and shock without manoeuvre cannot prevail, even against an outnumbered enemy. The principle of manoeuvre includes both the movement of troops and the application of firepower, "manoeuvring fire" and similar tactical concepts. The Soviets realise that the need for swiftness does not always justify frontal attacks, as attempted by the Syrians in 1973.

Concentration of forces creates numerical superiority, reflected in the allocation of frontage as well as the massing of weapons. Armament norms must be met if the Soviets are to achieve their objectives. This does not mean numerical superiority either all along the front, or in a theatre of operations, but rather being superior at the decisive point at the decisive time. Identifying these is one of the highest tasks of military art.

"It is necessary to take the enemy by surprise" – V.I. Lenin. Surprise is becoming more important as a principle of Soviet operations. Surprise is seen as a key "force multiplier," making the Soviet forces much more effective than they would otherwise be. The Soviets would apparently be willing to forgo some of their numerical superiority and logistical preparation to ensure that lengthy mobilisation did not alert the enemy. The Soviets also realise that surprise requires great command skill and forces that can take advantage of it. The Soviets intend to both create and exploit surprise by rapid manoeuvre of their forces to turn it into a concrete advantage. The faster the tempo of an attack, the greater the chance of surprising the enemy and the less chance he will have to recover. Nuclear weapons have increased the importance of surprise, as has the introduction of accurate conventional battlefield weapons; even the most deadly ATGM is ineffective if it is surprised before it can be deployed.

Nuclear weapons underlined, for the Soviets, the fact that the wages of waiting to be struck by the enemy are defeat. But pre-emption is not limited to the use of nuclear weapons. Suvorov said: "The one who forestalls is victorious." Marshal Kulikov, when Chief of the General Staff, wrote that "the most important consideration" in modern war was to "oppose an attempted enemy surprise attack." This has led to the rejection of the defensive except to lead to the offensive.

The Soviets will use well developed security and deception plans to attain surprise, as they have done from the Stalingrad offensive in 1942 to the invasion of Czechoslovakia in 1968. The Soviet publication *Field Regulations for Staff* requires all plans at division or higher level to include a fully developed deception scheme. While the Soviets realise that although modern reconnaissance methods mean that there is no way to hide mobilisation, political surprise is still attainable. The invasions of Czechoslavokia and Afghanistan, as well as the Manchuria campaign of 1945, show that even extensive mobilisations need not rule out surprise if *maskirovka* (operational camouflage and deception) is used effectively.

Combat activeness is the principle of the offensive, and is often rendered as such. The Soviets stress bold and decisive action in all operations, even in the defensive. Combat activeness implies the maintenance of the offensive, and the end of the offensive is annihilation, which is frequently included as an operational principle.

Preservation of combat effectiveness includes proper

organisation, effective systems of command, control and communications, and maintenance of morale.

Conformity of the goal is identical with the Western principle of "the mission." Goals usually include a terrain goal, enemy forces to be annihilated (usually a secondary goal), and a time goal.

Co-ordination is seen in the emphasis on combined-arms operations throughout the Soviet military. This principle also includes what the West terms unity of command, which is followed in the Soviet emphasis on centralised command functions throughout the army. Co-operation between arms is as vital to Soviet operations as it is to tactics. It is a much broader term than the comparable Western concept of "combined arms". All-arms co-operation has been seen as *the* crucial factor in battle. In Exercise Berezina in 1978, "the impressive picture of precise collaboration" was "the turning point of the decisive battle." Centralised command also implements co-ordination between different formations or different strikes, ensuring co-operation as well as the maximum effective utilisation of available weapons. It is part of the Soviet "systems approach" to military affairs, which requires individual issues – weapons, tactics or larger entities – to be examined as components of a larger whole. This philosophy imbues the Soviet military, from the highest levels down to battlefield tactics.

These principles of war are basically offensive, and, as the principles are built around the primacy of the offensive, it should come as no surprise that Soviet weapons and tactics, even defensive ones, are also offensive. Doctrine dictates that the goal is not just to beat back the enemy or buy time; it is victory. Marxist-Leninist thought holds that if a world-wide war breaks out between the forces of socialism and those of capitalism, it can have only one result: the triumph of the socialist system. That is why the question so often asked in the West – does the Soviet Union think it can fight and win a future war? – must be answered in the affirmative. A nuclear war is seen as a war like any other, with a winner and a loser, and fundamentals of doctrine have outlasted the nuclear revolution in military affairs. What is at issue is the cost of such a victory and, more important, whether the world situation makes it necessary. In fact the Soviet Union appears to have no intention of starting a nuclear war but only of being ready for it, since the potential costs limit its use as a rational element of statecraft to only the gravest situations. Since 1945 the Soviets have used armed force sparingly but well.

In 1987 there were a number of declaratory statements recognising the limited utility of nuclear weapons for war-fighting purposes. Along with preparations and operational concepts intended to lead to strategic or theatre-level victory with conventional forces while forestalling NATO nuclear use, these declarations suggest that every effort is being made to fight conventionally if war comes, and that the conventional solution will continue to be preferred for as long as there is any possibility of a nuclear response from NATO.

The weapons and tactics of the Soviet Army are designed to maximise Soviet strengths and avoid weaknesses. Just as on the battlefield the Soviets would try to exploit success rather than redeem failure, they invest resources to be stronger at what they are good at rather than mend failures.

Continuing reports of Soviet incompetence could cause the West to become unwisely complacent. Taken out of context, Afghanistan, the problems flowing from the 1981 partial mobilisation against Poland, Chernobyl, and a series of spectacular naval disasters could give a picture of the Soviets as techno-midgets, presenting little threat to the West. A look at the enduring economic, social and agricultural difficulties of the Soviet Union and its relations with its allies also indicates that the problems are not limited to technology. But the Soviet Army does not have to be the best in the world; it simply has to be able to win in the end. Inefficient it certainly is, ineffective it is not. In this it shares some characteristics with wartime Western armies. It is big, so big that there is neither the time nor the resources to give in-depth training to all the thousands of platoon and company commanders. The large-scale mistakes – the exploding ammunition dumps, the poorly handled offensives – are also those of a large force full of short-service personnel.

The Soviets beat the Third Reich with an improvised army. The purges and the losses of 1941 carried away the pre-war army, but the Russians were able eventually to enter Berlin. The Army that defeated Nazi Germany has certainly not been reduced to a collection of bunglers and black-marketeers by the passage of time. The Western focus on weapons and tactics should not obscure the fact that the Soviets have backed up these tools with a systematic and well thought out approach to war that has no equivalent in the West.

Chapter Two

Command and organisation

High Command

The top bodies in the Soviet national command structure are the Council of Defence, the Main Military Council, the Ministry of Defence, and the General Staff.

The Politburo, the central decisionmaking apparatus of party and government, controls all the nation's resources and their allocation, as well as the direction and form of policy and who shall carry it out. It can also focus on low-level decisions which have ramifications in these areas. The Politburo will make decisions on controversial or costly defence programmes, starting, reviewing or halting them. As the Party's senior leadership, it directs the Party's relationship with the Soviety military. The top military representative is the Defence Minister. But although previous Ministers of Defence have been full members, the current Minister, Marshal Yazov, like his immediate predecessor Marshal Sokolov, is but a "candidate" (non-voting) member. The Politburo is drawn from the 300 or so members of the Central Committee. While the Politburo retains final authority on major policy decisions, it is likely that the recommendations of the Council of Defence on military-related matters are usually acted on.

Comrade Mikhail Gorbachev, General Secretary of the Communist Party of the Soviet Union (by 1987 Gorbachev still had not inherited Brezhnev's title as Supreme Commander-in-Chief of the Warsaw Pact), is also chairman of the Council of Defence. Its members are probably all Politburo members, including the Minister of Defence; the Second Secretary of the Party; the chairmen of the Council of Ministers, Supreme Soviet and KGB; the Central Committee Secretary for Defence Industries; and possibly the Minister for Foreign Affairs, the Chief of Staff and First Deputy Ministers of Defence. Other Party and military heads may be called to attend meetings. The Council of Defence deals with preparedness at its highest level, ensuring that all the elements of the Soviet Union – armed forces, industry, transport, Party – are fit for any possible conflict. The Council has broad and far-reaching powers to affect the make-up and organisation of the Soviet armed forces. It may draw up five-year plans and make major procurement decisions.

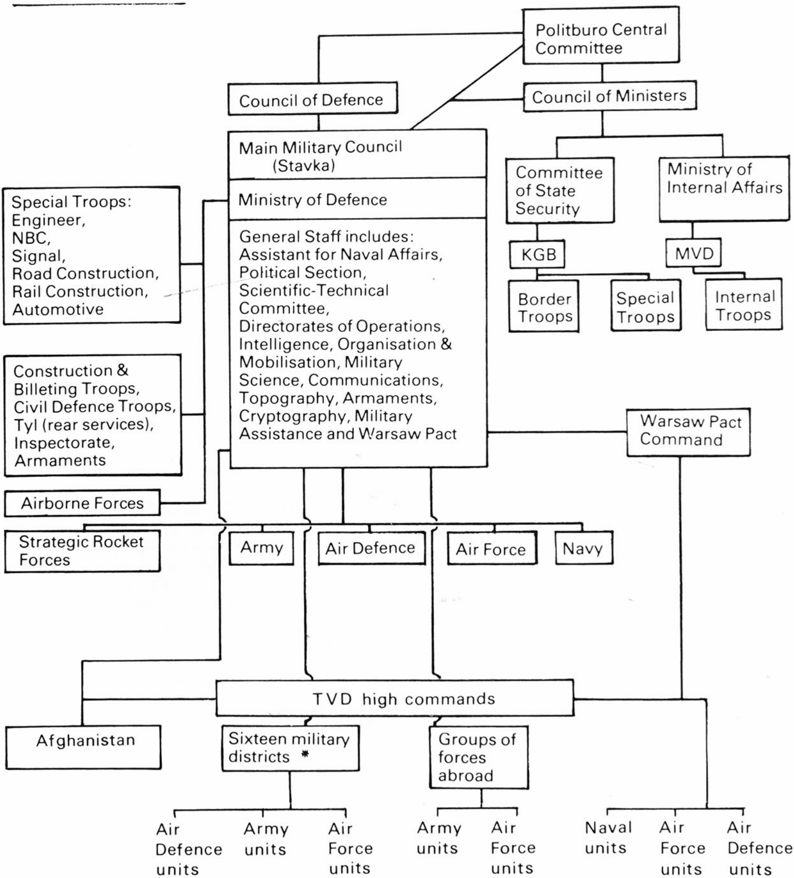
The Council of Defence is the most senior decision-making body for all aspects of national security policy. In wartime it would probably be expanded, functioning in a manner similar to that of the Second World War State Defence Committee. General Secretary Gorbachev would act as chairman, thus exercising direct leadership of the Soviet armed forces as Supreme Commander-in-Chief of the *Verkhovnoe Glavnokomandovaniye* (VGK, the successor to the wartime Supreme High Command) and head of its General Headquarters (*Stavka*), as well as the entire political and economic direction of a conflict. In peacetime the Council of Defence defines national defence policy, plans its implementation, and allocates resources, subject to Politburo approval. It is the highest element of national control, whereas the Politburo is the highest element of national political policy formulation. A Military Industrial Commission is probably attached to the Council of Defence.

The Ministry of Defence Collegium is a consultative body and policy review board. Membership includes the Deputy Ministers of Defence, the Chief of the Main Political Directorate, and the service chiefs. The Collegium would probably provide the foundation for the wartime *Stavka*, which would also include Gorbachev. The Collegium is part of the Main Military Council of the Ministry of Defence.

The Main Military Council is the Defence Ministry organisation that supervises the management and direction of the armed forces. The Soviet General Staff currently acts as the Main Military Council's executive agent. Marshal Sokolovskiy described the *Stavka*'s purpose: "The direct leadership of the Armed Forces during a war will obviously be accomplished, as before, by the *Stavka* of the Supreme High Command. The *Stavka* will be a collegial agency of leadership under the chairmanship of the supreme commander-in-chief." In peace, as in war, this body is concerned with strategic planning, leadership and direction. Membership includes the Party Secretary (Comrade Gorbachev), the Minister of Defence (Marshal Yazov), his three First Deputy and ten Deputy Ministers of Defence, the Chief of the Military Political Administration, and the commanders-in-chief of the five Soviet armed services: the Strategic Rocket Forces, the Army, the Air Force, Air Defence and the Navy. In addition, the chiefs of civil defence, construction and railway troops, and rear services are also presumed to be members, as are the Deputy Minister of Defence for armaments and the Inspector-General.

The General Staff, immediately subordinate in peace-time to the Main Military Council and to the *Stavka* in wartime, is the brains of the Soviet military. It has apparently been the driving force in the evolution of Soviet strategic and operational thought since the mid-1970s, using the findings of research staff at the Voroshilov

HIGH-LEVEL ORGANISATION



(* Strategic reserve military districts not under TVD command.)

(General Staff) and Frunze (Staff College) academies, as well as a constellation of other research institutions. In 1988 the General Staff was headed by Marshal S.F. Akhromeyev and had operational control over the armed forces. In wartime the General Staff would carry out the strategic and operational orders of the Supreme High Command. The General Staff is the link between the political leadership and the armed forces. It exercises actual operational control over the armed forces and has exclusive responsibility for translating strategy, doctrine

and policy into action. This degree of centralisation greatly exceeds that of the General Staff's Western counterparts.

In peacetime the General Staff handles military planning, implements decisions of the Council of Defence, and oversees the readiness and training of the operational commands. The General Staff has authority over operations, with its "battle staffs" providing centralised control. In peacetime it directs and co-ordinates the services as well as research and development. The General Staff also has high-value formations subordinated directly to it; these include high-power artillery brigades and strategic-mission air armies.

The General Staff, unlike its US counterpart, exercises line authority over the Soviet armed forces. It controls and directs the ground, naval, air, air defence, and strategic rocket forces as well as the 16 military districts, air defence districts, naval fleets, groups of forces, and headquarters of the Warsaw Pact. It develops and executes a unified strategy for the operational commands. In wartime the General Staff would serve as operational staff and executive agent for the *Stavka*, with the main staffs of the five services providing service-specific expertise. The Main Operations Directorate of the General Staff would draft strategic operations plans for the *Stavka*. Once approved, these plans would be issued to intermediate-level commanders (such as those of TVDs) as orders of the VGK.

The General Staff has ten directorates, for operations, intelligence, organisation and mobilisation, military science, communications, topography, armaments, cryptography, military assistance and the Warsaw Pact. It also has a political section, a scientific-technical committee, and an assistant for naval affairs.

The orders of the General Staff go to the operational commands: fleets, air-defence districts and, for the Army, military districts. Most of the military districts would probably generate front headquarters in wartime. The theatre of military operations (*Teatr Voyennykh Deistviy*, TVD) level of command lies between the General Staff and the fronts, although in peacetime it does not apparently form an intervening level between the General Staff and the military districts. Although these forces remain under the administrative direction of their parent service, the General Staff has operational command. The Soviet Army units stationed in the USSR in peacetime are assigned to 16 military districts. The only exceptions are the airborne divisions, which, though located in a military district and drawing support from it, are under the direct command of the Minister of Defence. Each military district provides the means for centralised control of all the sinews of modern war in a particular area; thus it is far more than a simple territorial command. In the case of nuclear war the military districts would probably be expected to maintain a partially self-sufficient war effort, reorganising both the economy and the administration. The military district must therefore be capable of organising and commanding land and air forces to be projected out of the district, as well as remaining in charge of the full-scale "mobilisation of the rear" that the Soviets see as crucial to victory.

The Minister of Defence is assisted by 13 Deputy Ministers of Defence, eleven of whom are members of the Central Committee of the Communist Party (helping to assure proper relations between party and military). The functions of the Ministry of Defence are similar to those of its Western counterparts, though with more concentration on decisionmaking power in the Minister and his associates. The General Staff is the organ of the Ministry of Defence by which the forces are actually commanded.

The emergence of TVD-level high commands (GTVD) as peacetime intermediate command levels was perhaps the most significant change of the many that took place in the late 1970s and early 1980s. Forces under GTVD command would include one or more fronts and air, naval and air defence units.

The changes in military posture created by the establishment of peacetime intermediate command levels have been felt throughout the force structure. The reorganisation of the army's air defence troops and those of the Troops of National Air Defence (PVO *Strany*) became logical because both would be integrated at TVD and military district levels. Similarly, the disbandment of Frontal Aviation's numbered air army headquarters has not only reduced headquarters "tail" but allows some of their former component forces to be either centralised under TVD or decentralised under army command. Thus in peacetime air combat units are directly subordinate to the headquarters of the Group of Forces or military district where they are stationed. This includes units that were part of the PVO and formerly subordinate to separate PVO districts, now reduced to one (Moscow).

By the mid-1970s the Soviets had decided that some TVD high commands should be formed in peacetime. This change may have been driven in part by advancing technology, with the TVD replacing the front as the focus of operational thinking because of the greater capability – including longer range – of modern conventional weapons. Systems such as the Su-19 Fencer fighter-bomber, able to strike throughout Europe, demanded a central command.

There appear to be five continental TVDs: Northwestern, Western, South-western (or Balkan), Southern (or Near Eastern) and Far Eastern; four maritime TVDs: Atlantic Ocean, Pacific Ocean, Indian Ocean and Arctic Ocean; and four intercontinental TVDs: North American, South American, African and Australian. Only four of these have high commands. The existence of separate maritime TVDs does not mean that the Soviets foresee a separate war at sea.

The first operational peacetime TVD high command is

believed to have been the Far Eastern, reformed in about 1978 under General Petrov, then fresh from the first Soviet operational-level battlefield victory since 1945 (commanding Ethiopian forces in 1977). The original Far Eastern TVD high command was set up for the war with Japan in 1945 and remained active until 1953. The Southern TVD high command was apparently activated before the invasion of Afghanistan in 1979. Western TVD high command was certainly active when Marshal Nikolai Ogarkov took command in 1985.

Designation of an organisation as a "high command" and its commander as a "commander-in-chief" is significant indeed. Only the service chiefs and the chief of Group of Soviet Forces Germany share this distinction. This change means that the peacetime command structure is now much closer to the wartime one. Marshal Ogarkov is believed to command the Western GTVD. General Zaitsev, in command of Southern GTVD, is believed to have authority over the war in Afghanistan. South-western TVD High Command was reported to be active under General Gerasimov in 1985. It is unlikely that the North-western TVD High Command had been fully deployed by 1987.

The creation of peacetime TVD headquarters has been accompanied by substantial improvements in command, control and communications, including the construction of several hundred hardened, bunkered command posts and communications centres; and the creation of an extensive communications system and numerous, well equipped mobile signals and headquarters support units. In wartime the command system would feature both hardened fixed command posts and mobile (including airborne) units; communications networks with redundant channels, and extensive camouflage, concealment and deception.

The fact that the TVD level of command integrates all of the services is underlined by its designation as a high command of the forces in the TVD. It would have primary responsibility for the "theatre operation," securing victory, if not in the war then at least within the theatre. Under its control would be several fronts, a naval fleet or units (if applicable), strategic air defence elements, and any strategic air army and airborne elements allocated by the Supreme High Command.

Each TVD has one or more strategic directions, defined as a strip of terrain leading to vital objectives. Strategic directions are the subject of operations by fronts or fleets. Each strategic direction comprises one or more operational directions, with less decisive goals.

Not all Soviet forces would be under the command of TVDs or fronts at the start of a war. Forces retained immediately under the control of the Supreme High Command for employment or allocation at its discretion would include strategic air armies, units of the Strategic Rocket Forces, airborne forces, Military Transport Aviation, a large strategic reserve of ground forces (primarily units stationed in the interior military districts of the USSR), nuclear-capable artillery, and an extensive logistic support structure.

Soviet TVD-level commands would also incorporate allied forces, though the level at which Warsaw Pact forces would be integrated under Soviet command is not apparent. As in 1944–45, allied armies could be placed directly under Soviet fronts, bypassing the national levels of command. It is also possible that the level of integration might be lower, with divisions or possibly even regiments being put separately under Soviet commands.

It is probable that since the 1970s all or at least a major part of the armed forces of the Warsaw Pact states (with the exception of Romania) have been under a unified command. These forces would certainly be used operationally under Soviet fronts and GTVDs, since the Soviets have a single strategic policy for the entire Warsaw Pact. Marshal Kulikov, Commander-in-Chief of the Warsaw Pact, has referred to his command as a "unified combat formation". Non-Soviet Warsaw Pact forces would probably be integrated under the Western TVD command, with the Warsaw Pact Joint Staff joining or at least supporting the High Command of the Western TVD.

TVDs are, by themselves, mere geographic areas. Their boundaries often overlap: continental TVDs include contiguous waters, while maritime TVDs include coastal areas. The division of territory into TVDs predates the establishment of TVD high commands by many years.

The front would operate within a theatre of operations (TVD) but could also operate independently, directly subordinate to the Supreme High Command. The General Staff could also directly control fronts, using General Staff "battle staffs" and *Stavka* representatives. A front itself is similar to a Western army or army group. It has one or more armies under its command, plus Air Force units, designated Frontal Aviation because they are subordinated to front command. Airborne divisions would also be attached to front command in time of war, as may naval units for a specific mission. Each front has a large and well staffed headquarters, significant logistic support, and many specialised units attached directly to it.

The army is a standard operational unit. Normally parts of fronts, they can also operate independently. Closer to Western corps than armies, Soviet armies consist of a number of divisions – usually about four – and specialised combat, combat support, and logistical units, in addition

to their headquarters. By the mid-1980s there were probably about 27 army and 10 corps-level headquarters.

Soviet corps are used for independent operations in areas which do not require a full army. For example, the two Soviet divisions earmarked for operations against northern Norway are organised into a corps. Such corps have a headquarters and logistic support units. Combined-arms corps are basically large divisions with multiple brigades, and possibly have an OMG role.

The Communist Party of the Soviet Union maintains elements of control throughout the armed forces, from Secretary Gorbachev down to the company political officers. At the top of the Soviet leadership the Minister of Defence is a Politburo member (although a non-voting one), and most of the key military personnel, including the service chiefs, are members of the Central Committee. These groups have direct inputs to all levels of the Soviet high command. The Main Political Administration, a section of the Central Committee, operates as an independent body within the Ministry of Defence. The Main Political Administration is responsible for political education, education and deployment of political officers, and control of the ideological content of all military activities as well as supervision of military Communist and Komsomol activities. Each of the five services has its own political directorate, and each military district or unit its political department or section. The political officer is usually designated *zampolit* (deputy commander for political affairs). The Main Political Administration is also represented on staffs, military councils and planning bodies, maintaining political input and control.

The Main Political Administration influences the leadership of the Party and its political activities. It exercises the authority of a section of the Party's Central Committee, issuing daily directives on political issues to subordinates throughout the chain of command. It is supervised by an outside Party Commission, set up by the Central Committee. The Chief of the Main Political Administration ranks above a Deputy Minister of Defence. The system, widely exported, aims to reconcile the basic, hegemonistic, total control of the Party over all Soviet life and institutions with the needs of the military.

The power of the Main Political Administration is tremendous, carrying the words of the Party and its *apparat* to every soldier. However, in the uniquely Soviet system of checks and balances even these guardians of the Party need guarding. Thus the KGB, which is not under the Ministry of Defence, has an "oo" section in every military unit down to regimental level, acting as a counterbalance to the political officers and performing security tasks.

The Committee of People's Control uses military personnel as a sort of political inspector-general's office. These organisations are another way in which the party can retain control of the military and be aware of what it is doing. Their efficacy is demonstrated by the fact that no Communist state has ever been overthrown by military coup. The boast that "the Party and the Army are as one" is not an empty one.

The production of defence-related equipment is in the hands of nine military-oriented and eleven primarily civilian machine-building and metalworking industries, the former controlled by the ministries of Aviation, Shipbuilding, Electronics, Radio, Defence Industry, "General Purpose Machinery," "Medium Machinery," Communications Equipment and Machine Building, the latter by the Automotive, Electrical Equipment, Agricultural Machinery, Heavy Industry, Instruments, Machine Tool, Chemical Machinery, Construction Machinery, Light Equipment, Animal Husbandry Machinery, and Power Machinery ministries. All of these experienced strong growth in their defence-related sectors during the Brezhnev era. The titles are deceptive: the Ministry of Medium Machinery is in charge of nuclear weapons development and production, the Ministry of General Purpose Machinery handles nuclear delivery systems, and most of the civilian ministries have military production functions. Defence industry plants will often use surplus capacity to produce civilian items. Other "civil" ministries have important defence-related functions: these include Assembly and Special Construction (military construction), Civil Aviation (integrated with the Air Force), Maritime Fleet (integrated with the Navy), Automation and Control Systems (computers), and Oil and Petrochemicals.

The Military Industrial Commission (VPK) co-ordinates the efforts of the defence industrial ministries and centrally supervises all weapon programmes. Operating across ministerial lines, the VPK, headed by a Deputy Chairman of the Council of Ministers, implements the joint resolutions of the Politburo and Council of Ministers relating to weapon programmes. These resolutions approve each programme once and for all for its full duration, in some cases including all foreseen developments. The Central Committee also retains oversight and control through its Defence Industry Department. Plan implementation measures are linked with those of the Government Planning Committee (GOSPLAN) and Government Building Committee (GOSTROI), both of which have major defence-related functions. The State Committee on Science and Technology acts to ensure, among other things, that defence industries have access to the latest technology.

The military representatives at each plant and design bureau are responsible for quality control and liaison with the services and Ministry of Defence.

Other arms

The centralisation inherent in the Soviet state means that the armed services have nothing near the autonomy of their Anglo-American counterparts. Indeed, since the mid-1970s they have yielded even more operational authority over their assets. But while disputes and rivalries are inevitable, it is wrong to believe that the Soviet armed forces suffer a "mirror image" of Western inter-service divisions.

The Soviet armed forces consist of five services, compared with the West's traditional three. The Strategic Rocket Forces is the premier service, making up in prestige what it lacks in tradition. It controls all land-based missiles bigger than the Army's Scaleboard. The Air Force is similar to its Western counterparts. Again as in Western nations, the Navy has a powerful air arm, both ship and shore-based (unlike the Army, which must rely on the Air Force for all its helicopters and aircraft). The Navy also includes the Naval Infantry and coast-defence units. The PVO *Strany* (Troops of National Air Defence) was a single service combining what were originally Army anti-aircraft and radar troops with Air Force interceptors and radar troops in a single service to counter the threat of strategic strikes against the USSR.

In 1981 the PVO *Strany* was reorganised. In a move towards greater integration of forces and reduction of headquarters staff, all except one (Moscow) of the air defence districts inside the Soviet Union were disbanded. Their functions continued but were carried out at military district level. This permitted the integration of PVO *Strany*, Air Force and Army assets in a more logical and efficient manner. (By 1987, however, control of at least some of these assets had been recentralised.) This removed the distinctions between the PVO, now known as the *Voiska* PVO (Air Defence Forces), and the Army's air defence branch. These re-organisations have reduced service divisions and led to a more rational allocation of resources.

The Army is responsible for standard equipment throughout the armed forces, and all services use the same small arms, trucks, NBC equipment and other non-role-specific equipment.

The Soviet Army itself is made up of a number of arms and branches. The Airborne Forces are the most autonomous, being almost an independent service. They have their own officers' school and publications and, in time of peace, report directly to the Ministry of Defence. In war conditions, however, the paratroopers will be integrated closely with the rest of the Army, and airborne units will be under front or theatre of operations command.

The *tyl* (rear services, equivalent to the Anglo-American administrative tail) has its own Deputy Minister of Defence. All units from strategic to tactical level in all services have a *tyl*, which includes the service support efforts of the unit. The commander of the Army *tyl* centralises and co-ordinates the service and supply activities of the Army. This includes both service support and peacetime housekeeping. The function of centralised supervision is performed through a number of branches of the *tyl* handling finance, medicine, military transport, food supply, clothing supply, military stores, automotive transport, quarters and veterinary medicine.

Most of these branches operate in the same way as their Western counterparts, providing centralised direction in specialised matters to units and sub-units while remaining operationally responsible to their parent unit in the same way that US Army medical personnel in a divisional field hospital are responsible to the Army Medical Corps although under the command of the divisional commander. The branches need not even be from the same parent service as the headquarters that has operational control of the unit. This is how a Soviet divisional commander may have control of an Air Force helicopter squadron or a *Voiska* PVO SAM regiment.

Other branches of the *tyl* have a distinctly Soviet function. Military Transport and Automotive Transport are jointly responsible for planning and filling the Army's transport needs, employing air, land or sea systems as required. Automotive Transport administers the *autokolonna* system, upon which the Soviet armed forces depend for many of their trucks. Under this system, trucks used throughout the Soviet economy for civilian tasks are built to standard military designs and earmarked for military use upon mobilisation. The civilian agencies using these vehicles are responsible for maintaining them to the satisfaction of the Army, and they are inspected twice a year (although bribery of inspectors is not unknown). As civilian truck drivers are often reservists of the Automotive Troops (a branch of service equivalent to the British Royal Corps of Transport or the US Transportation Corps), truck and driver can be called up together. This was done for the 1968 invasion of Czechoslovakia, with devastating results for that year's harvest. This system is also reported to have encountered major difficulties in the mobilisation of the western military districts against Poland, starting in November–December 1980, with large numbers of trucks and drivers not reporting as ordered or being at the wrong place at the wrong time. It worked better for the invasion of Afghanistan, which reminded the West that there is really no such thing as a civilian truck in the Soviet Union. The Afghanistan mobilisation, however, was slower and less widespread. The majority of the Army's motor transport requirements in the Soviet Union above division level are met by the *autokolonna* system.

The Central Food and Clothing Supply administrations aim for a high degree of self-sufficiency. Not only do they procure goods from civilian sources, but they produce material themselves. Soviet military state farms, with both

military and civilian workers, provide a large percentage of the Army's requirements, especially in Asia. These are supplemented by unit gardens, which are often large and well organised. The Army also has its own clothing and boot factories. This makes the Army independent of the civilian economy, with its inefficiencies and frequent failures. The Quarters Administration serves a similar function in maintaining and sustaining Army installations.

The Soviets realise the importance of the *tyl*, whether it is the central *tyl* of the Ministry of Defence, the *tyl* of the Army, providing strategic support, or a regimental *tyl*, run from the unit's rear command post and responsible for the day-to-day support of the regiment. The Soviets believe that the organisation of this special supporting service will free the fighting soldiers to fight and give them the necessary support.

The Construction and Billeting Troops are a separate branch of the Army with a high degree of autonomy. Despite its large size – 100,000 to 400,000 men – this force is not widely known. It is basically a mobile military labour force, its prime mission being the construction of military installations and anything which might be of military value, including the 1980 Moscow Olympic site and the new Moscow International Airport. They also supplement the troops of the Railway and Road Construction branches on these projects, especially on the Baikal–Amur Railway. Men in the Construction and Billeting Troops receive only the basic 30-day conscript's course and do little military training in the remainder of their two years' service. They also receive less political education than combat troops. Large numbers of Asians serve in these units, as well as, reportedly, conscripts who are not qualified to serve in combat units. However, it has also been reported that the men of these units need building experience and share in the reimbursement the Ministry of Defence receives when they do work for other government bodies. In addition to giving the Army its autonomous construction force, insulated from the civilian economy, this force gives the Soviet Government the capability to perform quick, efficient construction work in all conditions. Substantial forces of Construction and Billeting Troops were committed to the Soviet build-up in Afghanistan.

The Civil Defence Troops, like the *tyl* and the Construction and Billeting Troops, is a separate force, headed by a Deputy Minister of Defence and reporting directly to the Ministry of Defence. Also like those forces, it will work in conjunction with all the Soviet armed services at a strategic level, and not just with the Army. The Civil Defence Troops were removed from the Ministry of Internal Affairs and placed under the Ministry of Defence in 1961. Some 50,000 to 100,000 troops are assigned to this force, reflecting the increasing emphasis the Soviets have placed on civil defence in recent years. These troops administer and organise civil-defence efforts. Other civil-defence troops form units under the command of military districts, supplementing civilian efforts. These include fire-fighting, medical, decontamination and rescue units.

In contrast to the normal branches within the Army, such as Artillery and Tanks, certain other branches have "Special Troops" status. This means that while they are completely integrated within the Army, these branches are directly subordinate to the Ministry of Defence, and their mission includes the support of the other armed services as well as the Army. They differ from the *tyl*, Construction and Billeting Troops and Civil Defence Troops in that their commanders, though senior generals or marshals, are not Deputy Ministers of Defence. The Engineer, Chemical, Signal, and Automotive Transport branches are all in this category, and they all function in the same way as their Western counterparts. The Railway Troops and Road Construction Troops are also "Special Troops" branches, and have uniquely Soviet functions. The Railway Troops units play a key role in building and maintaining railways in the Soviet Union and lines of communication abroad. The Soviet-gauge rail lines through Poland to East Germany were built and are run under the supervision of the Railway Troops, as are railways throughout the Soviet Union, in particular the Baikal–Amur Railway. The Railway Troops man all military trains in the Soviet Union, and have their own locomotives and rolling stock. In wartime they would be expected to keep the railways open in the face of powerful enemy air and missile attacks, and to facilitate this prefabricated bridge components are dispersed throughout Eastern Europe, especially near the vital Vistula and Oder bridges, along with Railway Troops and Engineer detachments to erect them should the bridges be knocked out. The Railway Troops would also accompany attacking Soviet forces, and would try to make captured railways usable for Soviet logistic support as quickly as possible. The Soviet Army still depends on railways for its strategic mobility and logistic support, so the Railway Troops are a very important service.

The Road Construction Troops build and maintain roads that have a military value. Like the Railway Troops, they have done much peacetime construction work in the Soviet Union, especially in the Far North and Siberia. In wartime they would repair roads as well as build them.

The Soviet Army maintains a number of fortified areas. Use is said to be made of old tank turrets in defensive belts in the Far East and elsewhere. The Soviets have apparently put renewed emphasis on the Fortified Area Troops since 1973, possibly with combat lessons from the Middle East in mind.

The Soviet Army still employs disciplinary battalions, combining a combat role on mobilisation with peacetime responsibility for detention and corrective training of incredible severity. The Soviet Airborne Forces (VDV) is reported to maintain its own penal battalion. According to unconfirmed reports, this was in action in Logar province, Afghanistan, in 1985–86.

There are other military ground forces outside the Army. The Naval Infantry forces of the Northern, Baltic and Black Sea fleets today each consist of one high-readiness and one mobilisation-only brigade and one *Spetsnaz brigada* (special forces group). The Pacific Fleet's Naval Infantry component has been greatly strengthened, and now consists of a division HQ, two brigades or regiments, and one or more *spetsnaz brigadas*. There are defence battalions tasked with the security of shore installations; these may be organised like Army defence battalions. Total peacetime strength of the Naval Infantry is probably over 18,000, with mobilisation strength likely to be two or three times this level. Equipment is standard Army issue.

There has been an effort to make the Naval Infantry an elite force by allowing it a higher quota of recruits with pre-conscription military training and above-average intelligence test scores. Sub-units specialise in mountain, Arctic and airborne operations, and naval infantrymen also man the weapons on amphibious warfare ships, crew hovercraft, act as beachmasters for the movement of Army forces, and are trained in field construction.

The Naval Infantry's basic mission is amphibious assault, either alone or in conjunction with either motorised rifle or airborne units. Assaults are classed as strategic (projecting forces to open up a new theatre of operations), operational (landings to support the operations of Soviet forces in a theatre of operations) or tactical (landings to support a specific battle). Naval Infantry would probably be used chiefly for operational landings in support of the Soviet Navy in a theatre of operations. Despite having an impressive amount of shipping, the Soviet and Warsaw Pact amphibious lift capability is essentially short-ranged, with operational objectives rather than strategic ones. In peacetime the Naval Infantry assists the Soviet Navy in its task of projecting Soviet influence abroad.

The Soviet Army has also trained a number of its motorised rifle divisions in amphibious warfare, which they can perform independently or in conjunction with the Naval Infantry. Once ashore, the motorised rifle division would relieve the Naval Infantry regiment and continue the offensive.

The size of a *Spetsnaz brigada* is uncertain, but assets are believed to include a variety of manned and unmanned midget submarines, commandos inserted from submarines, and frogmen. Teams of specialist marksmen are tasked with the assassination of enemy leaders.

In addition to those of the four main fleets, there are Naval Infantry units with the Caspian Sea Flotilla at Baku, the Danube Flotilla, headquartered at Izmail in Bessarabia, and the Amur River Flotilla at Blagoveshchensk and Khabarovsk. None of these forces is likely to exceed a battalion in size.

The Soviet Navy also has a substantial coast defence force. In the early 1980s a new coast defence division headquarters was established in the former Japanese northern territories.

Most significant coast defence formation is the Missile Force. Organised in the early 1950s and originally equipped with a Soviet-built twin-engined guided version of the German V-1, it now uses the SSC-1 and probably the newer SSC-3, the latter on a self-propelled wheeled launcher. There are three 15-18-launcher battalions in the Northern Fleet, six in the Baltic Fleet, five in the Black Sea Fleet, and five in the Pacific Fleet.

Coast defence units also include a number of gun batteries. It is believed that the 130 mm naval coast gun is still in service, as too are a number of pre-war large-calibre weapons.

Far more sinister than this force of sea-soldiers are the armed forces of the Ministry of Internal Affairs (MVD) and the Committee for State Security (KGB). These do not come under the Ministry of Defence: under the Soviet system of checks and balances – someone must guard the guardians – these forces are directly responsible, through their parent Ministries, to the Council of Ministers. The armed forces of the MVD and the KGB are organised along military lines and equipped with standard Army weaponry, including APCs, scout cars and tanks. Conscripts serve in these forces instead of doing military service, and must be of undoubted political loyalty.

The MVD Internal Troops, known as the VV (*Vnutrie Voisk*, Interior Army), are organised into motorised rifle regiments and about 30 territorial divisions and a single division-sized motorised rifle formation, the *Feliks Dzherzhinsky*, in garrison outside Moscow. They are an elite, almost praetorian, formation. The VV is organised into four branches: special purpose (*Osnaz*), convoy troops, guard troops, and railway troops. The mission of its 175,000 men is the maintenance of internal security. In peacetime they operate as riot police when normal militia and police are insufficient. MVD troops mounted regiment-sized operations against Baltic and Ukrainian partisans until 1953, and were used in riots in the USSR in the early 1960s. During particularly intense rioting in Rostov province in 1963 even the MVD was not adequate to restore law and order, and the regular Army had to be called in. In addition to regular line MVD units, there are select detachments to handle special missions and difficult situations. In wartime, the MVD will restore order after strategic attacks, guard key factories, installations and transportation lines, guard POWs and political prisoners, and may even be committed to the front lines.

The KGB Border Troops, 175,000 strong, are responsible for the 67,000 kilometres of "iron curtain" surrounding the Soviet Union. Most of the border clashes with the Chinese have involved these troops. In addition to the detachments that man outposts, check passports at points of entry and patrol the borders, the Border Troops

maintain tactical reserve units to respond to any large-scale border incident, calling for support from the Army if necessary. The Border Troops have a naval arm equipped mostly with patrol boats, and use many light aircraft in their border patrols. They retain the last remaining cavalry units in the Soviet military. More significantly, they have large numbers of Mi-8 Hip-C, Hip-E (the latter with appliqué armour) and Mi-24 Hind helicopters. The Hind force – in 1987 probably still equipped mostly with Hind-A – is based mainly on the Chinese border. In wartime this formation would act as a covering and delaying force against any invasion of the USSR. They would also be responsible for internal security and anti-partisan and other rear-area protection tasks. They could also perform their rear-area protection role as security regiments or battalions while attached to armies operating outside the Soviet Union. KGB Border Troops have been used in the war in Afghanistan, opposing occasional resistance raids on Soviet territory, maintaining two battalion-size "mobile groups" inside the country, and advising the Afghan Government's border troops and other armed forces.

Afghanistan is not the only combat the Border Troops have seen. A Border Troops unit equipped with BTR-60s fought the Chinese at Damianskiy Island in 1969, and others have recently won gallantry decorations in fighting against unspecified enemies elsewhere in the Soviet Union.

The largest Border Troops organisation is the district, controlling 1,000–3,000km of border. Subordinate border detachments each control 100–500km. Each detachment consists of a mobile group, organised as an Army unit, and a number of border commands, which control the outposts, each of which is responsible for 5–25km. The border is very deep, up to 500km in places. In some areas, including many adjoining Afghanistan, the border has been depopulated for a day's march distance.

Border Troops are not subordinate to the military districts in which they are deployed, although they maintain close liaison. The Border Troops apparently run their own agent and intelligence-gathering net, distinct from that of the "regular" KGB.

The Border Troops is not the only KGB military formation. In addition to its well-known espionage activities, in which it co-operates with the GRU (Military Intelligence), the KGB maintains a further special armed force. Although the Internal Troops are considered more elite than the Border Troops, this KGB force is more elite than either. It is entrusted with the most sensitive tasks in the Soviet Union, including the guarding of nuclear stockpiles and extremely important installations and personnel; it also guards and operates the high-level strategic communications between high party, military and government officials, and between major military headquarters and their superiors. These troops, with their royal blue lapel tags, are also seen guarding Lenin's Tomb.

DOSAAF – the Voluntary Society of the Army, Aviation and Navy of the USSR – is a quasi-military organisation that fulfils an important military role. Although the DOSAAF works closely with the armed services and its chairman is an active-duty officer, it is not part of the Ministry of Defence, but is under the Central Committee of the Communist Party. DOSAAF's mission is to encourage military and civil-defence awareness amongst the whole population, but its main task is to provide pre-conscription military training for Soviet 16 and 17-year-olds. Under the 1967 Law on Universal Military Service, which reduced service time from three to two years, basic training, and even a large amount of technical training, was theoretically not to be performed by the Army but rather by DOSAAF, working with the trainees during their secondary education or during their employment between leaving school and being conscripted. This is where the Soviet soldier will supposedly learn the manual of arms, the elements of military drill and courtesies, and how to use infantry weapons. Instruction in advanced subjects is also provided. Parachuting, APC and tank driving and maintenance, and radio use and repair are all taught by the DOSAAF, using equipment phased out by the Army and using retired officers as instructors. However, DOSAAF is far less effective in practice than in theory. Only 50% of Soviet conscripts have received the pre-military training that DOSAAF is supposed to provide, and which the two-year term of service is based upon. Thus Army units have to train their half-yearly intake themselves for six months before they cease to be "dead wood". Only the Strategic Rocket Forces and the Airborne units can claim to have complete pre-conscription training for their personnel. DOSAAF also helps to maintain the military skills of reservists, working as part of the GTO sport and training organisation. DOSAAF has been criticised for being large, cumbersome and bureaucratic even by Soviet standards.

Objectives, echelons and reserves

The second echelon of a unit is distinct from its reserve and has no current Western equivalent (although the British Army of the First World War attacked in what the Soviets would call two echelons, and Soviet accounts of the Battle of El Alamein refer to the British armoured divisions being in the second echelon). In Soviet practice, a second echelon has a mission assigned before the start of an operation, although this can be altered, while reserves receive their mission during its course, although this can be preplanned. The second echelon of a unit is intended to exploit the success of the first, and can relieve the first echelon while it rests and resupplies, or, more often, attack alongside it.

Keeping the pressure on the enemy by day and night is emphasised throughout Soviet offensive thought, and to do this effectively a second echelon is required to join in the offensive, usually between first-echelon units. The second echelon can also attack in a different sector or direction, consolidate gains and mop up bypassed strongpoints, and defeat counter-attacks. If the first echelon has been repulsed, the second echelon resumes the attack.

The concept of deploying units in echelons is a key to Soviet offensive and defensive operations and tactics. All units, from front down to regiment and frequently to battalion, usually have two echelons and a reserve, although this can be increased to three echelons for breakthrough attacks against prepared defences or decreased to a single echelon when covering a wide front or encountering light resistance.

The Soviets prefer operational echelonment, but if strategic surprise has been attained or there is no coherent defence they may attack in a single echelon, either tactically or operationally. Under such circumstances a front of four armies, for instance, would all be in one line, concentrated on one main and one secondary axis of advance or a number of smaller ones. But if strategic surprise is unattainable, the same four armies could be deployed on a narrower front, two to an echelon. In the Second World War deep, strict echelonment was by no means universal.

Echelonment makes it possible to achieve numerical superiority without massing all the necessary forces on line, and to maintain this superiority through the commitment of fresh forces in the enemy position.

The first echelon of an attacking unit often comprises two of its component units of the same type reinforced by strong attachments, advancing abreast. If a wide front must be covered, or if two component units are concentrated on a narrow sector, three such units will be put in the first echelon. The Soviets will also put fewer units in the second echelon, pushing as many forward as possible, when the enemy is surprised, outmanoeuvred or unable to defend a broad front, or when objectives are close at hand and time is of the essence, or if nuclear weapons may be used and proximity to the enemy may provide protection. In these situations, regiments or larger units may have only a first echelon and a reserve. The three-echelon formation, on the other hand, closely approximates the armoured Soviet steamroller attack of popular imagination. It is used only infrequently, but would be employed in attacks on prepared defences, especially by tank units.

Command, control and communication will also determine how effective the commitment of the second echelon will be. As it comes up to the first echelon it will have to contend with returning traffic, including ambulances and vehicles going in for repair, as well as logistic vehicles going forward to resupply the first echelon. Traffic jams – making excellent targets – will be unavoidable.

Soviet tactical and operational reserves are small by Western standards; a battalion deploys a platoon, a regiment deploys a company, a division deploys a battalion, an army deploys a regiment (from a division in its second echelon) and a front deploys 3–5 divisions. Reserves are sometimes co-located with the unit main headquarters to speed response. In addition, some battalions and most regiments, divisions and operational formations would deploy a separate anti-tank reserve to assist the reserve in defeating armoured threats in both offence and defence. Neither reserve is usually assigned a specific offensive mission, but is used by the commander to meet unanticipated situations or change the direction of the attack. In defence the anti-tank reserve is a mobile backstop to the first echelon, while the reserve, normally positioned behind the second echelon, is the counter-attack force, supplemented by the forces of the unit behind it. These small tactical reserves, as compared with the traditional Western "two up, one back" deployment, show the Soviet emphasis on keeping the pressure on with the maximum number of troops in contact with the enemy. Even in the defence, the offensive orientation of Soviet military thought is apparent. Soviet numerical superiority allows tactical or operational units to depend on units echeloned behind them to perform functions that the larger and more self-sufficient Western units would rely on their own reserves to perform.

The Soviet system of unit frontages and objectives– the width and depth of the area to be attacked – is linked to their system of echelons and reserves.

Each Soviet unit is assigned a sector to attack or defend. In addition, each unit of division size or larger will have a main and secondary axis of advance within this sector. This can be altered as circumstances require: an operational formation advancing over a broad front against a surprised opponent might use multiple axes of advance. To achieve the required correlation of forces for victory, the Soviets will adjust their frontages to concentrate forces at the main sectors at the decisive moment. A superiority of three or five to one in tanks, six or eight to one in artillery and four or five to one in motorised rifle strength is normally required, although the Soviets will attack a force that outnumbers them even by two or three to one if they believe they can achieve complete surprise, or if the enemy has been neutralised by NBC or conventional fire. To achieve these levels of concentration in the main sectors, the Soviets will not only adjust unit frontages but will, if required, assault with intervals between units, relying on security parties, reserves and, primarily, the speed and shock of the attack to protect the open flanks. But more than massing forces, the Soviets will seek to achieve these norms by looking at the "force multipliers" of surprise, suppression and the mutually

Frontages and deployments

	Company	Battalion	Regiment	Division	Army	Front
Attack sector	1	2–3	5–10	20–40	100–200	200–500
Main frontage	0.75	1–2	4–7	10–15	40–80	80–250+
Depth (immediate objective)	–	2–3	4–5	8–10	100–150	250+
Depth (subsequent objective)	–	4–5	8–10	16–20	200–250+	300–500
Defence frontage	1–1.5	4–7	8–16	20–30	100–150	250–350
Defence depth	0.5–1	1–3	7–10	16–20	100–130	200–250
Rear boundary (from front)	–	3–5	10–15	30–40	75–110	150–160
Distance between echelons (attack)	–	1–3	5–10	20–30	30–35	40–80+

1 All figures are in kilometres. If NBC weapons are not expected to be used in the near future, fronts and armies have their sectors reduced by 40%, their attack frontages reduced by about 10% and their immediate objectives by about 40%. Note that units normally only operate over a portion of their attack sector for the main attack; the rest is ignored or covered by holding attacks. This will result in gaps between Soviet penetrations.

2 At any level of command a Soviet first echelon need not disengage when the second echelon is committed, both echelons fighting together for the subsequent objective. A division's subsequent objective (a one-day goal) is not the same as its parent army's immediate objective (a three to five-day goal).

reinforcing impact of the attacks. They realise that they may not be able to prevail through sheer weight of numbers, and so will seek to have the required superiority at the decisive point.

In addition to the width of its sector, each attacking unit of battalion size and above is assigned a depth of attack which contains an immediate and subsequent objective or mission. Each unit or formation will also have a direction of further attack, while divisions may have a mission of the day, stating directed tasks in priority order for a 24-hour period. Once the component units (for example, a regiment's first-echelon battalions or a division's first-echelon regiments) have achieved their immediate objective or fulfilled the immediate mission, the parent unit normally commits its second echelon, which then seizes the parent's unit's subsequent objective or fulfils its subsequent mission alongside the first echelon. The immediate objective of a parent unit is usually the same as the subsequent objective of its first-echelon component units. Because each unit has two echelons, a telescoping, expanding system of exploitation is formed. The Soviets believe that this will provide the momentum, the fresh troops and high combat power that the high-speed offensive requires in mobile warfare. Thus when a regiment has seized its immediate objective, it will commit its second echelon and go on to seize *its* subsequent objective, which is the immediate objective of the division. At this point the division commander will commit his second-echelon regiments to seize the division's subsequent objective. This is not the same as the army's immediate objective. Once it is seized, the army will commit its second-echelon divisions to seize its subsequent objective, which is the front's immediate objective. Front will then commit its second-echelon armies, including the tank armies, which are designed for long-range operational exploitation. Though it is not seen as the only route to success – deep echeloning was not used in a number of winning Second World War campaigns – this system maintains the momentum that the Soviets regard as essential to victory.

Combined arms

Combined arms, in the Soviet sense, is more than mere cross-attachment of tactical units. It represents the effective integration of a broad range of weapons and forces at all levels of command, being either all-branch or all-service.

The Soviets have recognised the importance of combined-arms operations since the 1930s, but their tactical skill and weapons often did not allow them to translate their ideas into effective reality. In the Second World War the Soviet Army improved its effectiveness by abandoning sophisticated combined-arms organisations and tactics and adopting simple, direct units, using them in a way that minimised its weaknesses and optimised its strength. Today the Soviets have refined their operational and tactical thought and equipped themselves with adequate weapons, so that all operations and all tactics down to company level or below are carried out by combined-arms forces. Each Soviet weapons system and each element of Soviet tactics must be perceived as an element in this overlapping, complementary, integrated system. The value of the whole is greater than the sum of its parts.

Soviet tank and motorised rifle divisions have a three-to-one mix of regiments. Each motorised rifle regiment has a similar mix of battalions, as do tank regiments, which each include a motorised rifle battalion. Until the 1970s the tank regiment was a single-arm force. This vestige of wartime organisation was probably due to the Soviet belief that the tank is supreme on the battlefield

and that tanks are the best counter to anti-tank weapons. Other factors were the absence of an effective infantry combat vehicle for use with tanks until the introduction of the BMP, and the fact that tank units are not intended to make breakthrough attacks. Tank regiments in motorised rifle divisions have no motorised rifle battalion.

Artillery is organic to regiments, divisions and higher formations, and it is integrated into combined-arms forces either by direct attachment to tank or motorised rifle units or by forming artillery groups. Divisions and regiments both include a full range of organic combat support units, such as anti-tank, anti-aircraft, engineer, reconnaissance, and signals units, as do larger organisations. They are also provided with headquarters capable of preparing detailed but short-term and short-range plans. The official word on the big picture tends to come down from the top, limiting even front commanders. Each unit from regiment upwards is also capable of independent operations. To facilitate this, they all incorporate a range of service support and logistic support units. While lean by Western standards, this element of the combined-arms offensive is seen as adequate for the relatively short distances and brief periods of combat that the Soviets envisage. Battalions (except independent battalions) and smaller units, being sub-units, lack headquarters capable of independent operations, combat support units and logistic support. When operating independently, they will have to be reinforced with these assets from higher headquarters.

Combat support units and artillery are normally attached downwards to create reinforced combined-arms tactical units. Thus a division will attach many of its organic combat support sub-units, such as air defence, engineers or artillery, to its first-echelon regiments, while a regiment will similarly attach its combat support assets to its first-echelon battalions. Artillery is also allocated in a similar manner, either through direct attachment to lower headquarters or through the formation of artillery groups. The Soviets do not form combined-arms forces by cross-attaching component units in the way that British tank and mechanised infantry battalions or companies will exchange companies or platoons. Soviet attachment works in one direction – downwards – and the Soviets will not break up the integrity of a unit by attaching its assets elsewhere. While combat support units may be attached to other units – although they are also frequently employed whole – combat units are not. Soviet units, from platoon to division, will fight as integral units, not as part of a battle group, whenever possible. Divisions which are understrength – as a result of either combat losses or incomplete mobilisation – may be combined. Because Soviet divisions in Afghanistan have responsibilities for broad areas, most division or regiment-sized forces put into the field there are composites, with battalions and regiments drawn from different formations. This also ensures that the troops sent into the offensive are drawn from fully trained subunits and have all the required equipment. Thus of the five Soviet regiments committed to the Panjshir VII offensive in 1984, two came from 103rd Guards Airborne, one from 104th Guards Airborne and one from 360th Motorised Rifle, and one was an independent airborne regiment.

An exception is the tank battalion of the motorised rifle regiment. While it is capable of operating as a unit, this battalion's three companies are usually attached to each motorised rifle battalion of the regiment, which, in turn, attaches a platoon to each of its three companies, giving each motorised rifle company commander a combined-arms force of BMPs or APCs and four tanks. The tank company and battalion headquarters still retain control of the tanks, and they can be redistributed within the regiment as the situation requires. While less is known of the way motorised rifle battalions organic to tank regiments operate, it is believed that they are attached down in the same way.

The second exception to the use of combat units as integral wholes in battle are the battalions of the tank regiment of a motorised rifle division or, more often, the motorised rifle regiment of a tank division. These battalions may be removed from their parent regiment (which is usually in the divisional second echelon) and attached to regiments in the divisional first echelon. Each battalion can either be used as an integral battalion within the regiment or broken down and attached to individual battalions and companies, as are tank battalions organic to motorised rifle regiments. These attached battalions will however revert to control by their parent regiment once the regiment, in the second echelon, is committed. This is similar to the way artillery groups have their control transferred from centralised to decentralised command during the artillery offensive. Artillery groups, being *ad hoc* groupings of artillery battalions rather than organic regimental formations, are the third exception to normal Soviet combined-arms practice. However, with the possible exception of some heavy guns, Soviet artillery battalions are never mixed up, although batteries are often attached to sub-units. Engineer units are also formed into mission-orientated task forces for specific purposes.

Tactical air operations

Tactical air operations are the responsibility of the Soviet Air Force. The Soviets realise the importance of tactical air power and attempt to integrate it into the overall mission as closely as possible.

The TVD High Command has authority over a broad range of air units. It is likely that, on mobilisation, each GVTD will have deputy commanders for air and air defence, responsible for planning and executing the

Independent Air Operation.

The front commander is assisted by the chief of aviation (also referred to as the deputy front commander for aviation). An aviation command post is established in or near the front main command post. The front commander establishes targeting and strike priorities, but the aviation commander executes the missions. The deputy commander for air defence is responsible for controlling the front's air defence assets. The army commander, like his superior the front commander, determines fire support priorities, but the planning and execution of the mission will rest with the army aviation commander and his staff. Aircraft transiting a front's area do so through corridors during designated times. Air defence units are alerted as to the locations and time durations of these corridors. At the division level, a team of combat control officers handle target designation and the guidance of aircraft using data from ground radars and computers. They probably also coordinate strike aircraft to avoid accidental fire from the division's air defence weapons. The division's air defence officer would be in close contact with the combat control officers. At the regimental level, experienced pilots are assigned to serve as air force guides. They direct ground-attack aircraft and helicopters in close air support missions. They advise the regimental commander on using aerial fire support assets and serve as a link between the regiment and supporting aviation units. Control and target identification posts, staffed with combat control officers, provide navigational aid to Soviet aircraft transiting the area and vector ground-attack aircraft on to targets. These units are positioned with forward battalions.

Fighter units provide air cover for ground units and tactical aircraft. When operating on the defensive, they normally remain at medium or high altitude, leaving low-altitude air defence to air defence units. Fighter units will also aim to achieve air superiority by defeating enemy aircraft. Now that the distinction between Frontal Aviation fighters and IV-PVO interceptors – in organisation, if not in training and tactics – has largely disappeared, the Soviets can tailor their air defence resources to the required tasks. Air cover continues to use ground controlled interception tactics, which make the Army's early warning radars important for fighter direction in the forward areas. Increased capability of Soviet aircraft has made autonomous and semi-autonomous combat operations more likely.

Air strikes will also be used to gain air superiority by attacking enemy airfields, using the element of surprise whenever practical. They will be supplemented by long-range rockets. Soviet tactical air strikes can either be by two or four aircraft, flying low, or by larger forces, perhaps 16 or more, in massed raids. Both types have been seen in Afghanistan. A third or more of a strike group may be fighters. Strikes are normally pre-planned at front or army level, although division have their inputs through the air liaison team and can request air strikes.

Air strikes are not usually made on targets in contact with Soviet forces, or in the course of what Western forces would consider close air support. Exceptions are the support of airborne operations by fixed-wing aircraft and helicopters, hasty river crossings, mountain operations, and units which have outrun their artillery support. Close air support missions, performed by attack helicopters, have become increasingly important in recent years. Minimum safety distance between ground troops and air strikes in peacetime ranges from 200 to 700 metres. Under actual combat conditions, air strikes may strike closer.

The priority targets of tactical air strikes will include nuclear weapons and their means of delivery (including enemy airfields), headquarters, communications centres and enemy reserve and artillery units. They will also be used for interdiction, which will be planned over a wide front with a centralised command.

Interdiction, however, is not considered the primary way conventional airpower influences operations in depth. It is rather through "air accompaniment", which resembles an operational-level independent air operation but is performed in direct support of the Army. While independent air operations are usually planned at TVD level, air accompaniment is usually planned at front level. The Soviets realise that aircraft provide the best source of flexible, responsive, conventional firepower in the depths of the enemy defence. Air accompaniment includes both the preparatory strikes before an attack and strikes flown in support of the Army forces after the attack has been launched.

Air reconnaissance is an important role of Frontal Aviation. In the Second World War it was one of the most important missions: 25–30% of all sorties were for reconnaissance. Reconnaissance missions can be flown by all Frontal Aviation units, but specialised reconnaissance regiments and helicopter regiments will carry much of the burden.

Soviet tactical aircraft have high sortie rates because of their technical simplicity. However, these will probably decay significantly over extended periods as a result of the centralisation of maintenance and support functions away from the squadrons. Although four or five sorties a day are possible in a surge, a capability of two to three sorties a day for the first three days of operation, followed by a decreasing rate of one to two sorties a day, is more realistic. More complex modern aircraft present greater problems.

Operational unit organisation

Front

HQ and HQ elements

A number of armies (a typical front might have 3–4 combined-arms armies and one or two tank armies)

One or more airborne divisions may be attached
One or more special operations forces
Aviation of Front command
One or two artillery divisions
One artillery brigade (possibly)
One RVGK heavy artillery brigade
Two SS-1 SSM brigades
One to three SS-12/SS-22 SSM brigades (to disband)
Two to four SA-4/SA-12 SAM brigades
One signals brigade
One NBC defence brigade
One radar regiment
One air defence jamming regiment
One long-range reconnaissance battalion
One psychological operations battalion
Two pontoon bridge regiments
One to three engineer brigades
One to three assault river crossing battalions
One radioelectronic combat battalion
One RVGK signals brigade
One radio relay battalion
One intelligence regiment
One material support brigade (assets include 18+ truck battalions, 6+ of them for POL; one pipeline battalion; one tank transporter battalion, 335 transporters)
Three construction regiments
One maintenance brigade
Rear base (see page 501)

There is no fixed front organisation; all unit attachments are variable.

Typical Aviation of Front

HQ
HQ light transport squadron (11 aircraft)
Three fighter and fighter-bomber divisions, each comprising three 48-aircraft regiments
One or two reconnaissance regiments (32 aircraft each)
One transport helicopter regiment
One ECM helicopter squadron
One general-purpose helicopter squadron

Typical army

HQ and service elements
Four or five divisions (a combined-arms army will typically have two to four motorised rifle divisions and one or two tank divisions. A typical tank army has three or four tank divisions and one motorised rifle division)
One artillery brigade/regiment (independent)
One rocket launcher regiment
One artillery command and control battalion
One or two SA-4/SA-12 SAM brigades
One SS-1 SSM brigade
One air assault battalion
One tank brigade or regiment
One attack helicopter regiment
One general-purpose helicopter squadron
One signals regiment
One pontoon bridge regiment
One assault river crossing battalion
One tank transporter regiment (335 transporters)
One air-defence radar battalion
One long-range reconnaissance battalion
One traffic control battalion
One medical regiment
One engineer brigade
One NBC defence battalion
One signal intercept battalion
One radio relay battalion
One radar intercept battalion
One radioelectronic combat battalion
One combat intelligence battalion
One material support brigade (1,000+ trucks)
Service support elements

Tank armies differ from combined-arms armies mainly in name but may lack the tank brigade and some EW assets.

Naval Infantry brigade (2,900–4,363 officers and men)

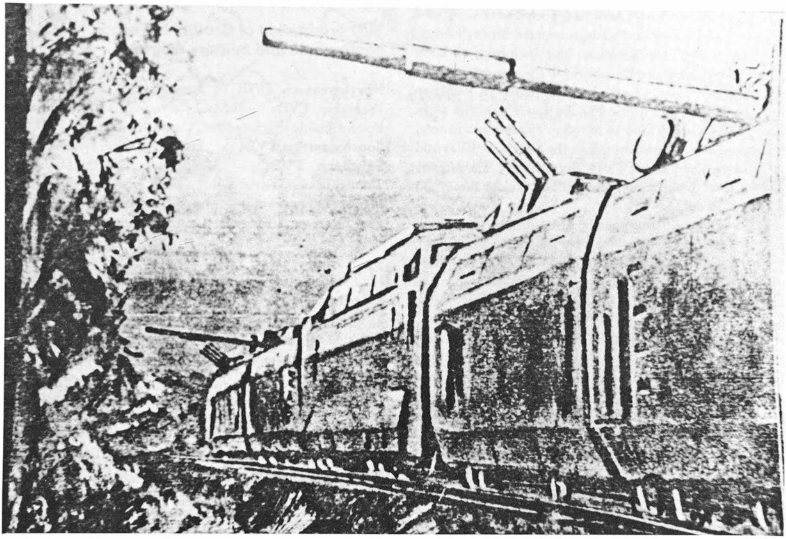
HQ company
Four infantry battalions (as motorised rifle battalions with BTR-60PBs and 2B9 mortars; one battalion is air assault-trained and may have BMDs)
One signals company
One NBC defence company
One tank battalion (T-72 and PT-76)
One reconnaissance company (including BRDM-2s and BTR-60s)
One engineer battalion (including 20 PTS-M)
One 122mm SP howitzer battalion
One air-defence company (ZSU-23-4s and SA-13s)
One BM-21 battalion
One anti-tank company (Saggers, Spigots and SPG-9s)
One medical company
One service company
One maintenance company
One rigging platoon

The brigade can be broken down into three independent battalion landing teams. Some BTR-60 PBs have been replaced by MT-LBs. Many Naval Infantry troops are airborne-trained. The mobilisation-only "shadow" Naval Infantry brigades probably lack much of the heavy equipment.

Armoured trains

The Soviets still use armoured trains. Current armoured trains are armed with ZSU-23-4 turrets, and T-44, early T-54 or T-62 tank turrets, or whole tanks on flatcars.

Heavily retouched photograph of a Soviet armoured train of the 1970s. Its long armoured carriages include two with ZSU-23-4 turrets, two with T-62 turrets, and one which appears to be a command post. These trains could be used on the Soviet-gauge rail lines that run through Poland to East Germany. The retention of the armoured train in the Soviet force structure – probably for internal security and route protection – may also result from combat lessons learned by the Red Army in the Civil War. Each is individually named (some are "Guards" trains), perpetuating a historic armoured train.



Chapter Three

Order of battle

Soviet Army order of battle

Since 1977–78 the Soviet Army is reported to have formed a number of divisions, including a coastal defence division. By 1984 it had 194 divisions (not including artillery divisions): 30 in eastern Europe, 65 in the western military districts (up from 64 in 1983), 30 in the Southern TVD (up from 29 in 1983), 52 in the Far Eastern TVD, and 17 in strategic reserve (up from 16 in 1983). In addition, in 1984 there were 860 tactical aircraft in the Southern TVD and 1,820 in the Far Eastern TVD. According to *The Military Balance*, total divisions had reached 204 tank or motorised rifle by 1986–88.

The number of Soviet tactical aircraft in the Groups of Forces and the frontier military districts (Leningrad, Baltic, Byelorussian, Carpathian and Odessa) increased from about 3,050 in 1979 to 4,425 by the end of 1984 (720 MiG-21, 2,510 MiG-23/27, 135 Su-7/20, 325 Su-17, 635 Su-24, and 100 Su-25).

Total equipment strength in 1984 (1986–88 in parentheses) was believed to be: 52,700 (53,300) main battle tanks, 1,200 (1,200) PT-76s, 80,000 AFVs (including 6,300 BRDM-series, 26,000 BMP-series, 2,500 BMD-series, 26,000-plus BTR-series, 2,900 MT-LB-series), 25,800 (29,000 including 4,580 SP) artillery pieces, 10,350 (11,100) heavy mortars, 6,400 (6,900) multiple rocket launchers, 3,500 man-portable ATGMs, 7,200 (7,250) anti-tank guns, 1,560 (1,570) SSM launchers, 4,225 (5,000) SAM launchers, 11,040 (12,000) anti-aircraft guns, 950 (1,560) attack helicopters, 175 electronic-warfare helicopters, 690 (750) general-purpose helicopters and 2,600 (2,150) transport helicopters.

A number of separate brigades have also been formed since the late 1970s. The Naval Infantry regiments were upgraded to brigades, and lower-readiness, mobilisation-only Naval Infantry brigades were formed, as were motorised rifle brigades in Afghanistan, and airmobile and air assault brigades and independent battalions.

Two divisions have been disbanded: the 6th Tank Division in East Germany and the 105th Guards Airborne Division in Afghanistan. In both cases the equipment and personnel remained in place. One of the motorised rifle divisions in Mongolia may disband in 1987–88. In Eastern Europe the component regiments of a division are not all co-located with the divisional headquarters given here. Instead, most are dispersed, often being stationed in pre-war German *kasernes* throughout the divisional area. In the Soviet Union, especially outside the western military districts, there are division-size garrisons.

TVD orientation of Groups of Forces, contingents and military districts

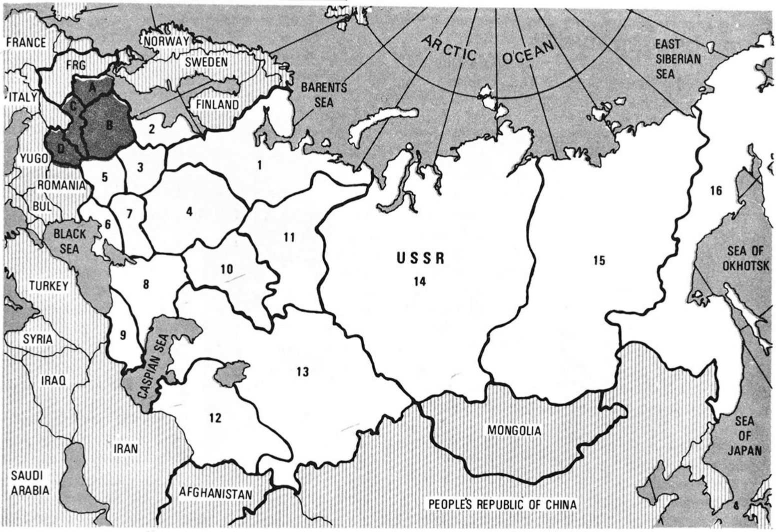
Northwestern TVD: Leningrad
Western TVD: East Germany, Czechoslovakia, Poland, Baltic, Byelorussian, Carpathian
Southwestern TVD: Hungary, Kiev, Odessa
Southern TVD: Afghanistan, North Caucasus, Transcaucasus, Turkestan
Strategic reserve: Moscow, Ural, Volga
Far Eastern TVD: Central Asia, Siberia, Transbaikal, Far East, Mongolia.

Unit types: G = Guards (honour title), MRD = motorised rifle division, TD = tank division, AASLT = airborne assault, ABND = airborne division, ARTD-A = full artillery division with 216–385 artillery pieces and 18–36 anti-tank guns, ARTD-B = artillery division with 72 artillery pieces and 18 anti-tank guns, Bde = brigade, Rgt = regiment, Bn = battalion, Cat = readiness category. Question marks show designations or locations unknown or uncertain. Where more than one designation appears, it has not been possible to ascertain the exact designation and alternative designations may be given.

Group of Soviet Forces Germany
Headquarters (with Air Forces headquarters): Zonsen-Wunstorf.

HQ 2G Tank Army: Fuerstenberg, Havel; 16G TD: Neustrelitz; 21 MRD: Perleberg/Prignitz; 94G MRD: Schwerin; 207 MRD: Stendal, Altmark. Army-level troops include: 2 Artillery Brigade (Dallgow); one SAM brigade; one SSM brigade (Dallgow); 413 (?) Engineer-Pontoon Regiment (Dallgow); one assault crossing battalion; one reconnaissance battalion (Fuerstenberg); one transport battalion (Fuerstenberg); 9 Signals Regiment (Fuerstenberg).
HQ 3 Shock (Tank) Army: Enke Kaserne, Magdeburg; 7G TD: Dessau-Rosslau; 10G TD: Altengrabow; 72G TD: Neuruppin; 47G TD: Hillersleben, Altmark. Army-level troops include: 304th Artillery Brigade (Burg); one SSM brigade; one SAM brigade; 36th Engineer-Pontoon Regiment (Magdeburg); one assault crossing battalion;

SOVIET MILITARY DISTRICTS AND GROUPS OF FORCES



Military districts: **1** Leningrad, **2** Baltic, **3** Byelorussia, **4** Moscow, **5** Carpathia, **6** Odessa, **7** Kiev, **8** North Caucasus, **9** Transcaucasus, **10** Volga, **11** Ural, **12** Turkestan, **13** Central Asia, **14** Siberia, **15** Transbaikal, **16** Far East. Groups of Forces in Eastern Europe: **A** Group of Soviet Forces Germany, **B** Northern Group, Poland, **C** Central Group, Czechoslovakia, **D** Southern Group, Hungary. *(US Army)*

890th Engineer Battalion (Stendal); one reconnaissance battalion; one transport battalion; 105th Signals Regiment.

HQ 20G Army: Panzer Kaserne, Eberswalde; 25 TD: Ubungsplatz-Vogelsang; 32G TD: Juterborg; 90G TD: Bernau; 35 MRD: Doeberitz, Potsdam. Army-level troops include: 71st Guards Artillery Brigade (Bernau); one SSM brigade (Juterborg ?); one SAM brigade; 3rd Engineer-Pontoon Regiment (Eberswalde); one assault crossing battalion; 51st Reconnaissance Battalion (Eberswalde); 26th Transport Battalion (Eberswalde); 118th Signals Regiment (Eberswalde).

HQ 8G Army: Fliegerhorst Kaserne, Nohra, Weimar; 79G TD: Jena; 27G MRD: Halle, Saale; 39G MRD: Ohrdruf, Thuringia; 57G MRD: Naumburg, Saale. Army-level troops include: 43rd Artillery Brigade (Altenburg); one SSM brigade (Jena-Forst, to disband); one SAM brigade; one engineer-pontoon regiment (Berenburg); 27th (206th) Assault Crossing Battalion (Gera); 880th Engineer Battalion (Rudostadt); one reconnaissance battalion; 257th Transport Battalion (Nohra); 91st Signals Regiment (Weimar).

HQ 1G Tank Army: Grenadier Kaserne, Dresden. 9 TD: Riesa; 11G TD: Dresden-Klotzsche; 20G MRD: Grimma. Army-level troops include: one SSM brigade (Meissen); one SAM brigade; 35th Engineer-Pontoon Regiment (Wittenberg); 120th Assault-Crossing Battalion (Spremberg?); 6th Reconnaissance Battalion (Dresden); one signals regiment (Dresden); one transport regiment (Dresden).

GSFG Troops: 34G ARTD: Dazu, Potsdam; 35 AASLT Bde: Cottbus; one *Spetsnaz* brigade (Fuerstenberg-Neuruppin-Neustrelitz); one SS-12/22 brigade (Neubrandenburg area); one SS-12/22 brigade (Bautzen area); two SAM brigades; one+ engineer-pontoon regiment; one independent motorised rifle regiment or brigade (East Berlin); two engineer regiments (Zossen-Wunstorf); one engineer pipeline brigade; one railway pontoon brigade (Annaburg); 38th Signals Regiment (Leipzig); 56th Transport Brigade. SS-12/22 brigades, forward-deployed to GSFG since 1978, are to disband as a result of the INF Treaty.


Soviet Union
International boundary
National capital
Railroad
0 400 800 Kilometers
0 400 800 Miles
Names are not necessarily authoritative.
The United States Government has not recognized the incorporation of Estonia, Latvia, and Lithuania into the Soviet Union. Other boundary representation is not necessarily authoritative.
Kuril Islands (administered by Soviet Union)
Occupied by Soviet Union since 1945, claimed by Japan
Arctic Ocean
North Atlantic Ocean
Norwegian Sea
North Sea
Baltic Sea
Barents Sea
Kara Sea
Laptev Sea
East Siberian Sea
Chukchi Sea
Bering Sea
Sea of Okhotsk
Sea of Japan
Yellow Sea
East China Sea
Philippine Sea
Black Sea
Caspian Sea
Aral Sea
Persian Gulf
Arctic Circle
NORWAY
SWEDEN
FINLAND
POLAND
ROMANIA
TURKEY
SYRIA
IRAQ
IRAN
AFGHANISTAN
PAK.
MONGOLIA
CHINA
JAPAN
Moscow
Leningrad
Kiev
Murmansk
Arkhangel'sk
Vorkuta
Novosibirsk
Omsk
Tomsk
Krasnoyarsk
Irkutsk
Yakutsk
Magadan
Khabarovsk
Vladivostok
Petropavlovsk Kamchatskiy
Tashkent
Alma-Ata
Baku
Tbilisi
Yerevan

GSFG attack helicopter regiments: Parchim, Stendal, Mahlwinkel, Brandis, Weimar-Nohra.
Army-level troops in each GSFG army include: one independent tank regiment (150 tanks); one air assault battalion; one *Spetsnaz* unit; one independent anti-tank battalion (12 MT-12 and 12 Spandrel on BRDM); one artillery brigade (48 2S5 or 24 each D-20 and 152mm M-1976); one Scud brigade; one SAM brigade (27 SA-4); one bridging regiment; one river-crossing battalion; one NBC defence battalion; one helicopter regiment.

All divisions in GSFG are Category I and in a high state of readiness within the category.

Honour titles of GSFG divisions include: 32G TD: Azerbaijan-Taman-Sevastopol; 94G MRD: Zvenigorodok-Pomerania-Berlin; 207 MRD: Pomerania-Berlin; 9 TD: Bobriusk; 11G TD: Carpathian-Berlin; 20G MRD: Carpathian; 7G TD: Kiev-Berlin; 10G TD: Ural Volunteer-Lvov, named after MSU Malinovskiy; 47G TD: Dnepropetrovsk-Smolensk; 12G TD: Uman-Korsun; 39G MRD: Barvenkovo-Posen; 27G MRD: Korsun-Novbuggin. 57G MRD: Smolensk-Stalingrad-Krivoi Rog-Kharkov.

Central Group of Forces
Headquarters: Mlovice, Prague.
HQ Army Boleslav: Mlada-Boleslav; 18G MRD: Mlada-Boleslav; 15G TD: Mlovice; 48 MRD: Vysoke Myto.
HQ 28 Corps: Olomouc; 31 TD: Bruntal; 30G MRD: Zvolen.
All units are Category I and stationed in Czechoslovakia. Non-divisional forces include one air assault battalion, one SS-12/22 brigade (to disband), one Scud brigade, one artillery brigade, one helicopter regiment, one SA-4 brigade.

Southern Group of Forces
Headquarters: Budapest-Matyasfold.
2 TD: Esztergom: 13G TD Veszprem; 93G MRD: Kecskemet; 253 MRD: Szekesfehervar.
All units are Category I and stationed in Hungary.

Northern Group of Forces
Headquarters: Schweidnitz.
20 TD: Sagan; 6G MRD: Borne.
All units are Category I. Non-divisional units include one Scud/SS-23 brigade, one attack helicopter regiment.

Leningrad Military District
Headquarters: Pedrozavdonsk.
HQ 6 Army: Pedrozavdonsk; Corps HQ: Vyborg; Corps HQ: Archangel; ? MRD (Cat II): Leningrad; 45G MRD (Cat III): Vyborg; 37G MRD (Cat I): Pargolova, possibly near Leningrad; 64G MRD (Cat III): Priozork and/or Sapermaye; 111G (376? 107?) MRD (Cat III): Sortavala; 77G MRD (Cat III): Iskagorka and/or Archangel; 45 MRD (Cat III): Murmansk and/or Pechenga; 34 (54? 341?) MRD (Cat II): Kandalaksha; 69 MRD (Cat III): Vologda; 76G ABND: Pskov; ? ARTD-A: Pushkin; ? ARTD-B: Pushkin; ? MRD: location unknown; ? MRD: location unknown.
The 45 MRD and 34 MRD are equipped with MT-LB APCs. 76G ABND is the "Chernigov" division.

Baltic Military District
Headquarters: Kaliningrad (Königsberg).
HQ 11G Army: Kaliningrad; 1 TD (Cat II) Kaliningrad; 1G MRD (Cat II): Kaliningrad; 149 (129?) ARTD-A: Kaliningrad; 344 (?) ARTD-A: Kaliningrad; 3G (23G?) MRD (Cat III): Klaipeda; 40G (28G) TD (Cat II): Sovetsk; 24G TD (Cat II): Dobele; 88 (56G? 36?) MRD (Cat III): Tallinn; 7G ABND (Cat I): Kaunas; 107 (16?) MRD (Cat III): Vilnus; 26G MRD (Cat III): Gusev (Gumbinnen); 44G (30? 5?) MRD (Cat III): Jonava; ? MRD: location unknown.
11 Guards Army is reported to have been trained as a highly mobile force, possibly to act as a TVD reserve or as a second echelon. 1G MRD is the Guards Proletarian Moscow-Minsk Division.

Byelorussia Military District
Headquarters: Minsk.
HQ 5G Tank Army: Bobriusk; **HQ 7G Tank Army:** Borisov; **HQ 28 Army:** Grodno.
120G MRD (Cat I): Minsk; 50G MRD (Cat III): Brest; 3G ARTD-A: Osipovici; 8 (46?) TD (Cat II): Slonim; 29 TD (Cat II): Slutsk; 3G TD (Cat II): Lepel; 27G (37G?) TD (Cat II): Poltosk; 8G TD (Cat I): Maryina-Gorka; ? MRD (Cat II): Borisov; 22 TD (Cat II): Bobriusk; ? TD: location unknown; ? TD: location unknown; ? MRD: location unknown. 34 TD (Cat II): Borisov; 47 TD (Cat II): Borisov; ? ARTD-B: Brest.
The 120G MRD is the Rogachev Guards Division. 103G ABND, formerly at Vitebsk, has been redeployed to Kabul; a new airborne division may be formed.

Kiev Military Distrct
Headquarters: Kiev.
HQ 1G Tank Army: Chernigov; **HQ ? Tank Army:** Dnepropetrovsk.
41G TD (Cat II): Artemovsk; 72G MRD (Cat III): Belaya Tserkov; 29G (25?) MRD (Cat III): Lubny; 4 MRD (Cat III): Lugansk; ? MRD: Vorishilovgrad, ? MRD: location unknown; 7 MRD (Cat III): Konotop; 18G TD (Cat II): Cherkassy; 20G TD (Cat II): Krivoi Rog; 75G TD (Cat II): Chuguyev; 42G TD (Cat II): Volnoye, near Dnepropetrovsk; ? TD (Cat II): Volnoye, near Dnepropetrovsk; 14 (?) TD (Cat II): Vypolozov; ? MRD: Chernigov; ? ARTD-A: Novomoskovsk; ? ARTD-A: Fastov; ? TD: location unknown.
Six of the Category II tank divisions were Category III as recently as the late 1970s and their readiness may be low.

Carpathia Military District
Headquarters: Lvov.
HQ 8G Tank Army: Zhitomir; **HQ 13 Army:** Rovno; **HQ 38 Army:** Ivano-Frankovsk.
70G MRD (Cat II): Ivano-Frankovsk; 15G MRD (Cat I): Vladimir-Volinski; 66G MRD (Cat III): Chernovtsy; 17 MRD (Cat III): Khmeinitskiy; 128G MRD (Cat II): Mukachevo; 61 MRD (Cat II): Uzhgorod and/or Izyaslav; 97G (17G?) MRD (Cat III): Slavuta; 24 MRD (Cat II): Lvov; 13 TD (Cat II): Novograd-Volinski; 117G TD (Cat II): Berdichev; ? TD: location unknown; 23 TD (Cat I): Ovruch; 26 ARTD-A: Kamenskaya-Bugskaya; 81 ARTD-A: Vinogradov; ? ARTD-B Kovel; ? ARTD-B: Turka.
24 MRD is the Iron Division, 15G MRD is the Kharkov Division. Two TD were Category III until the late 1970s at least. 66G MRD is a training division.

Moscow Military District
Headquarters: Moscow.
? G MRD (Cat I): Tambov; 13 (3?) MRD (Cat III): Kovrov; 32G MRD (Cat III): Kalinin; 2G (?) MRD (Cat I): Alabino, near Moscow; 4G TD (Cat II): Naro-Fominsk; 15G TD (Cat II): Gorkiy; ? MRD: Kursk; ? MRD: Kovrov; 106G ABND (Cat I?): Tula; ? ARTD-A: Kalinin; ? ARTD-B: Skopin.
The division at Alabino is the Taman Guards division. 106G ABND has a training role in the Tula-Ryazan airborne complex and so its readiness is probably lower than that of other Soviet airborne divisions. 4G TD is the Kantanamorets Yuri Andropov Division.

Odessa Military District
Headquarters: Odessa.
HQ 19 Army: Kishinev; Corps HQ: Simferopol (Crimea).
33G MRD (Cat II): Beltsy; 59G MRD (Cat II): Tiraspol; 98G (118G?) MRD (Cat III): Bolgrad; ? MRD (Cat III): Belogorod-Dnestrovskiy; 126 MRD (Cat III): Simferopol; 28 (286?) MRD (Cat III): Odessa; 128 MRD (Cat II): Feodosiya; 92 MRD: location unknown; 34 TD: Nikolayev; 102G ABND (Cat I): Kishinev; 2G ARTD-A: Zaporozh'ye.

North Caucasus Military District
Headquarters: Rostov. Corps HQ: Krasnodar; Corps HQ: Volgograd.
9 MRD (Cat III): Maykop; 73 MRD (Cat III): Novorossiysk; 266 MRD (Cat III): Volgograd; 4 TD (Cat II): Novocherkassk and/or Uryupinsk; 19 MRD (Cat III): Orzhonikidzye; 24G MRD (Cat III): Grozny; ? MRD: location unknown; ? MRD: location unknown; ? MRD: location unknown; 4 ARTD-A: Buynaksk and/or Mikhachkala.

Transcaucasus Military District
Headquarters, with staff 34 Air Army: Tbilisi.
HQ 7G Army: Yerevan; **HQ 4 Army:** Baku; **HQ 45 Army:** Kutaisi.
145 MRD: Batumi; 147 MRD: Akhalkalaki; 10G MRD: Akhalkalaki; 31G MRD: Kriovabad; 26 MRD: Kirovakan; 164 MRD: Yerevan; 261 MRD: Leninakan; 75 MRD: Nakhichevan and/or Dzul'fa; 6 MRD: Lenkoran; 216 MRD: Baku; 104G ABND (Cat I): Kirovabad; ? ARTD-A: Kutaisi; ? ARTD-B: Leninakan; 1G TD (Cat II): Tbilisi; ? airmobile brigade: Kutaisi; ? MRD: location unknown; ? MRD: location unknown.
Three of the MRDs are Category II, remainder Category III. One MRD is the Sivash-Stettin Division.

Volga Military District
Headquarters: Kubishev.
43 MRD (Cat III): Kubishev; 96 MRD (Cat III): Kazan; 21 MRD (Cat III): Totskoye; ? MRD: location unknown; ? ARTD-A: Totskoye.
Volga Military District headquarters may, in time of war, mobilise an alternative supreme command post for the entire Soviet military rather than a front headquarters.

Ural Military District
Headquarters: Sverdlosk.
77 MRD (Cat III): Sverdlosk; ? MRD (Cat III): Chebarku; ? TD (Cat II): Kamyshlov; ? MRD: location unknown; ? MRD: location unknown.

Turkestan Military District
Headquarters: Tashkent.
84G (54?) MRD: Kizyl-Arvat; 357 MRD: Kushka; ? MRD: Ashkabad; ? ARTD-A: Bikrava and/or Ashkabad; 360 MRD: Termez; ? MRD: Samarkand; ? airmobile brigade: location unknown; ? MRD: location unknown.
One of the MRDs is Category II, remainder are Category III. 357 and 360 MRD are Category I.

Limited Contingent of Soviet Forces in Afghanistan
Headquarters and HQ 40th Army: Termez, USSR (forward headquarters: Kabul).
103G ABND: Kabul, SW Camp; 108 MRD: Kabul, NE Camp; 201 MRD: Kunduz; 5G MRD: Shindand; 357 MRD: Kushka, USSR; 360 MRD: Termez, USSR; 70 MR Bde: Khandahar; 66 MR Bde: Jalalabad; 191 MR Rgt: Ghazni; 866 MR Rgt: Feyzabad; 56 AASLT Bde: Gardez; 375G ABN Rgt: Bagram; three *Spetsnaz* brigades: Kabul, Shindand, Khandahar; 40 Airmobile Bn: Kabul; 40 Airfield Defence Bn: Bagram; 40 Heavy Artillery Bde: Kabul; two KGB Border Guards mobile groups: Kabul and Herat.
Aircraft based in Afghanistan include 8–10 15-aircraft fighter-bomber squadrons and 270 helicopters. Units shown as located in the USSR are also listed under

Turkestan MD; they are probably under the operational control of the Limited Contingent HQ.

Central Asia Military District
Headquarters: Alma Ata.
HQ 1 Army: Semipalatinsk. ? MRD: Os' and/or Karaganda; 201 MRD: Frunze and/or Dushanbe; 8 MRD: Pereval Kurdai; 80 (?) MRD: Alma Ata and/or Otar; ? MRD: Sary Ozek; 165 MRD: Semipalatinsk and/or Ust-Kamenogorsk; ? ARTD-A: Semipalatinsk; ? ARTD-B: Aktubinsk; 15 TD (Cat I): Ayaguz.
MRDs are one Category I, two Category II, three Category III.

Siberia Military District
Headquarters: Novosibirsk.
? MRD: Abakan; ? MRD: Tumen and/or Itatka; ? MRD: Novosibirsk; 23 MRD: Biysk; ? TD (possibly MRD): Omsk; ? MRD: location unknown; ? MRD: location unknown; ? ARTD-A: Isham.
One MRD is Category II, remainder Category III; TD may be Category II.

Transbaikal Military District
Headquarters: Chita.
? MRD: Nizhneupinsk; ? MRD: Ulan Ude; 34 MRD: Sretensk; ? MRD: Dauriya; ? MRD: Borzia; 49 TD: Chita; 6 TD: Kyakhta; ? ARTD-A: Tsugol; ? ARTD-B: Naushka; ? airmobile brigade: Mogocha. There is a corps or army HQ at Chita.
Five additional MRDs are deployed in all or some of Irkutsk, Bezrechnaya, Baklashi, Gusmooresk and Mirnaya. MRDs include three Category I, one Category II, four Category III; one TD is Category I, the other is Category II (possibly III).

Soviet Forces Mongolia
Headquarters: Ulan Bator.
HQ 39 Army: Ulan Bator. ? TD: Baran Urt; ? MRD: Buigan; ? MRD: Sayn-Shand; ? MRD: Sumber Soma; ? TD: Choybalsan (Urf Durfal).
TDs include one Category I and one Category II, MRDs, at least one Category I (at Sayn-Shand).
In mid-1987 there were reports that one of the MRD HQs had moved to Irkutsk (Transbaikal MD), although

Summary of Soviet Army deployment by readiness category (late 1970s)

District country	MR divisions I	MR divisions II	MR divisions III	Tank divisions I	Tank divisions II	ABN divs	Total line divisions	Artillery divisions A	Artillery divisions B
East Germany	10	–	–	10	–	–	20	1	–
Czechoslovakia	3	–	–	2	–	–	5	–	–
Hungary	2	–	–	2	–	–	4	–	–
Poland	–	–	–	2	–	–	2	–	–
Carpathian MD	1	4	3	1	2	–	11	2	2
Leningrad MD	1	1	6	–	1	1	10	1	1
Baltic MD	–	1	5	–	3	1	10	*2*–1	–
Byelorussia MD	1	1	1	1	*5*–7	1	*12*–10	1	1
Kiev MD	–	–	*5*–4	–	7	–	*12*–11	2	–
Moscow MD	2	–	2	–	2	1	7	–	2
Odessa MD	–	*3*–4	4	–	*1*–0	1	9	2	–
North Caucasus MD	–	–	4	–	1	–	5	1	–
Transcaucasus MD	–	3	*7*–8	–	*1*–0	1	12	1	1
Volga MD	–	–	3	–	–	–	3	1	–
Ural MD	–	–	2	–	1	–	3	–	–
Turkestan MD	–	1	4	–	–	1	6	1	–
Central Asia MD	3	2	1	1	–	–	7	–	2
Siberia MD	–	1	3	–	1	–	5	–	1
Transbaikal MD	3	1	4	1	1	–	10	–	2
Mongolia	*1*–2	–	–	1	1	–	*3*–4	–	–
Far East MD	*5*–6	7	6	1	1	1	*21*–22	1	5
Totals	**32**	**25**	**60**	**22**	**30**	**8**	**177+**	**16**	**17**

Where figures are uncertain, italic figures are counted.

leaving its weapons in place, as part of the announced withdrawal of 11,000 Soviet troops from Mongolia.

Far East Military District
Headquarters: Chabarsovil.
HQ ? Army: Belogorsk; **HQ 5 Army:** Ussuriyask; **HQ 15 Army**, Corps HQ: Yuzhno-Sakhalinsk.
31 MRD: Belogorsk and/or Svobodnye; ? MRD: Svobodnye; 265 MRD: Vozhayevka; ? TD: location unknown; ? MRD: Blagovershensk; 194 MRD: Khabarovsk; ? airmobile brigade: Magdagachi; 22 MRD: Petropavlovsk, Kamchatka; 3 MRD: Kuril Islands; 73 MRD: Komsomol'ska-Amur; ? MRD: Dzeingy and/or Khabarovsk; ? MRD: Birobidzhan; ? MRD: Lermontovka; ? MRD: Sebuchar; ? MRD: Lesozavodsk; 29 MRD: Kamen-Rybolov; ? MRD: Sergeyevka and/or Prograncynye; 79 MRD: Leonipovo-Sakhalinsk; 342 MRD: Yushno-Sakhalinsk; 17G MRD: Barabash and/or Kraskino; MRD: Ussuriyask; ? MRD: Smolyaninovo; ? TD: Sebuchar; ? TD: Prograncynye; ? MRD: location unknown; ? MRD: location unknown; 6G ABND (Cat I): Belogorsk; ARTDs: Toinichi, Birobhidzan, Ussuriyask, Yushno-Sakhalinsk, Pokrovka, Slavyanka (two "A," five "B" divisions); ? MR brigade: Provedennya, near Bering Strait; ? MR brigade: Anadya, on Bering Sea; *Spetsnaz* brigade: Yashil Station, near Khabarovsk; two fortified-area divisions: location unknown.
The two MR brigades and some divisions have artillery tractors or MT-LBs in place of APCs. It is possible that 6th Guards Airborne Division, unlike all the others in the Soviet Union, is under theatre command in peacetime rather than under direct command of the Ministry of Defence. The Naval Infantry (HQ Vladivostok) and coast defence divisions are also in the Far East.

The Soviet Army reportedly has three MRDs in the USSR fully cross-trained in mountain operations and several others – perhaps as many as five – that have alternative equipment appropriate for use in mountains or foothills. Other divisions are reported to have an amphibious mission, those on Sakhalin and some in the Leningrad Military District (especially the divisions at Archangel and Vyborg) being mentioned as examples.

Summary of Soviet Army deployment by formation type (1988)

District or country	Divisions				Brigades	
	MR	Tank	ABN	Arty	AASLT	Airmobile
East Germany	8	11	–	–	1	–
Czechoslovakia	3	2	–	–	–	–
Hungary	2	2	–	–	1	–
Poland	1	1	–	–	–	–
Carpathia MD	8	4	–	2	1	–
Leningrad MD	9	–	1	1	1	–
Baltic MD	7	3	1	2	1	–
Byelorussia MD	4	10	–	1	1	–
Kiev MD	7	8	–	2	–	–
Moscow MD	6	2	1	1	–	–
Odessa MD	8	1	1	1	1	–
North Caucasus MD	8	1	–	1	–	–
Transcaucasus MD	12	1	1	1	–	1
Volga MD	4	–	–	1	–	–
Ural MD	4	1	–	–	–	–
Turkestan MD	6	–	–	–	–	1
Afghanistan	3	–	1	–	1	–
Central Asia MD	6	1	–	1	1	–
Siberia MD	6	1	–	1	–	–
Transbaikal MD	10	2	–	1	–	1
Mongolia	3	2	–	–	–	–
Far East MD	22	3	1	2	2	1
Totals	**147**	**56**	**7**	**18**	**10**	**4**

Artillery: only "A"-type divisions are counted.

Summary of Soviet combat aircraft deployment (1988)

East Germany 1,750 fixed-wing/530 helicopters; **Czechoslovakia** 105/120; **Hungary** 240/50; **Poland** 240/50; **Carpathia MD** 350/160; **Leningrad MD** 240/150+; **Baltic MD** 288/80+; **Byelorussia MD** 350/200+; **Kiev MD** 90/30+; **Moscow MD** 145/80; **Odessa MD** 192/80+; **N. Caucasus MD** ?/1; **Transcaucasus MD** 453/620; **Volga MD** ?/–; **Ural MD** ?/1; **Turkestan MD** ?/–; **Afghanistan** 160/270; **Central Asia and Siberia MD** 410/145; **Transbaikal MD and Mongolia** 402/225; **Far East MD** 590/670.
Totals 5,150/4,400 approx

Totals do not include 1,760+ air defence aircraft.

In wartime conditions Soviet organisation will be different from that existing during peace. The Soviets will refer to units by a code number or name rather than a numerical designation, and may even change the numerical designation of a unit when it is committed to action to make it more difficult to keep an accurate order of battle; this practice creates much uncertainty about Soviet unit designations. In peacetime Soviet divisions in the USSR are not assigned to army or corps commands, but they are in wartime.

Before the 1987 INF Treaty the Soviet Army deployed SS-12M/22 brigades at the following locations in the USSR (number of launchers in brackets): Lapichi, Byelorussia MD (14); Saryozek, Central Asia MD (15); Gorniy, Transbaikal MD (14); Novosysoveyka, Far East MD (14). There were SSM-12/22 battalions at: Pashino, Siberian MD (4); Kattakurgan, Turkestan MD (5). There were SS-23 brigades at: Stankovo (18), Tsel (12) and Slobudka (12), Byelorussia MD; Bayram-Ali, Turkestan MD (12); Semipalatinsk, Central Asia MD.

Soviet forces abroad

Soviet troops and equipment outside the USSR

Country	Troops (Army)	MBTs	Artillery	Tactical aircraft	Helicopters	SSMs
East Germany	420,000	8,000	3,700	1,530	530	230
Czechoslovakia	85,000	1,500	740	130	120	50
Hungary	80,000	1,250	570	240	50	30
Poland	40,000	650	336	240	50	30
Afghanistan	118,000	320	586	150	270	12
Mongolia	65,000	1,500	700	?	?	32
Cuba	8,000	40	48	0	10	0

Soviet advisers abroad

Algeria 1,000, Angola 1,500, Congo 100, Ethiopia 1,500, India 200, Iraq 600, Kampuchea 200, Laos 500, Libya 2,000, Mali 200, Mozambique 300, Nicaragua 50, Peru 1,600, Vietnam 2,500, South Yemen 500, other 2,500

These figures are for all services. In the case of Ethiopia and Vietnam, the total includes forward-deployed Naval Infantry detachments.

Cuba: A "brigade" of one tank, three motorised rifle and one artillery (or MRL) battalions is stationed on the island. Many Soviet specialists are in Cuba and some Cuban units, notably the "armoured division", are heavily Soviet.

Readiness categories

The Soviet Army is more mobilisation-dependent than a Western army. Even in the high-readiness western military districts, units need substantial numbers of reservists to become effective, especially in the area of service support. Only the Groups of Forces and forces in Afghanistan are at the highest readiness. The mobilisation for the Czechoslovakian invasion in 1968 revealed many systematic weaknesses, from the low level of individual reservist training to the inability of the military districts to prepare their fighting divisions for crossing the border. The lessons of Czechoslovakia contributed to the changes at the military district level in the 1970s. The problems thrown up by the 1979 mobilisation for Afghanistan and that in 1981–82 for Poland have led to a new emphasis on improved procedures.

Category I: Unit at 75–110% (assault) strength in both men and equipment. Units outside the Soviet Union are usually stronger than Category I formations inside the Soviet Union, which can use reservists and mobilised civilian equipment. Equipment strength is usually higher than manpower strength.

Category II: Units are manned at 50–70% strength, the average being slightly more than 50%. Equipment strength is close to full strength, but less than Category I divisions and most is in storage. These divisions are deployable within 30 days of mobilisation.

Category III: Units are manned at 10–33% personnel strength, and usually have only 33–50% of their required equipment, most of this being in storage. Most of the major combat items are present, although they are usually older models. Some divisions are however missing entire regiments. Normally considered not deployable until between 90 and 120 days after mobilisation; some of the Soviet divisions that invaded Afghanistan in 1979 may have been Category III units mobilised in 60 days. The additional resources available when only a few divisions are mobilised at a time may have allowed a quicker mobilisation. It has been estimated that composite divisions could be put into the field 60 days after mobilisation by merging two Category III divisions into one. The additional personnel are reservists mobilised from the area in which the division is stationed, although this is not possible for units stationed in isolated areas, especially in the Far East and Siberia.

Mobilisation only: The Soviets are known to maintain a number of formations which have no peacetime existence except for a designated cadre, mainly reservists or retired personnel. Their use is probably not envisaged in a short, victorious war. There may be only five mobilisation-only formations with 500–600-man cadres; others (20+ ?) have smaller cadres. Equipment will come from national strategic reserve stocks, and civilian trucks or BTR-152s will probably be issued to motorised rifle units. Tanks will be T-54s (or maybe even T-34s), and artillery will be wartime vintage as well. Most, if not all, of these formations will be motorised rifle divisions. Mobilisation-only divisions are unlikely to be deployable even for second-line duties before 180 days after mobilisation.

Low-readiness Soviet divisions attain active-force status in a number of ways. Units may expand to the next higher level, using existing personnel as a cadre. Existing units may contribute a cadre or a new, identical "shadow" unit, both units then being topped up by reservists. Other units comprise only a cadre of serving personnel and are brought up to strength by reservists.

The categories described above are NATO concepts. The Soviets themselves apparently grade forces as "ready" (*razvertavie*), "semi-ready" (*polurazvertavie*), "cadre" (*kadrirovanaya*) or "training" (*uchebnaya*). There may be further distinctions within each category. Training divisions retain full operational capability; on mobilisation, the cadre, trainees and reservists would take the division into the field.

The Soviets have no reserve units that meet for regular peacetime training, as does the US National Guard, except for some small specialist units. In addition to bringing the existing force structure up to strength, Soviet reservists, especially the older ones, would also be used to form new units. It is likely that plans exist for full-scale mobilisation on the 1941–45 model.

One of the great flaws of Western analysis of the Soviet Army is the ever-present tendency to "mirror image," to assume that the Soviets do or perceive things in the same way as Western armies. This applies especially to Soviet weapons strength and policy.

Because of the size of the Soviet Army it is very rare that, except in wartime, one item of equipment ever totally replaces another, as, for example, the Chieftain replaced the Centurion in the British Army. Thus the M-30 122mm howitzer is still used in some units 25 years after the D-30 was introduced to replace it.

A number of the systems that emerged in the 1970s were issued in the following order: initial deployment in the USSR, especially the western military districts, followed by East Germany, then elsewhere in the Soviet Union. The Soviets frequently create a "high-low" mix of hardware, with high-cost, high-capability systems serving in high-readiness formations, while low-cost low-capability systems, more easily used by recalled reservists, serve in lower-readiness formations. Displaced high-capability systems may "migrate" downwards to lower-readiness units. Export customers frequently receive priority over Soviet forces and, except for East Germany, the members of the Warsaw Pact. Thus the Syrians have a quantity and variety of Soviet-built SAMs far exceeding anything the Soviet's Polish allies have.

The deployment of the T-64/72 series seems to have fitted this pattern, but others do not. The 1970s saw Category I divisions using T-54/55s while brand-new T-62s were delivered to Category III divisions.

The Soviets apparently have a large number of modified tables of organisation, all variations from the "standard" strengths, which must not be seen as typical. For example, the total number of BTRs is insufficient to equip every BTR unit on the standard scale.

Similarly, differences in unit organisation do not always seem to be linked to a readiness state or operational mission. Some tank battalions do have four tank companies, but they cannot be definitely linked with any particular mission or readiness category. Similarly, Soviet motorised rifle squads vary between eight and twelve men, with one or two machine guns, in a way that often belies the generalisations that Western sources wish the Soviets would fit themselves into. It is therefore incorrect simply to

Estimated Soviet force inventories (early 1978)

	Groups of Forces		Western MDs		Central MDs		Eastern MDs		Totals	
	Units	Store	Units	Store	Units	Store	Units	Store	Units	Store
Tanks										
T-54/55	2,666	–	4,025	–	9,379	–	7,252	–	23,322	–
T-62	5,932	–	4,145	–	1,596	33	2,379	–	14,052	33
T-64/72	1,747	–	757	–	1,367	–	–	–	3,871	–
Heavy (?)	252	–	31	–	1,303	423	755	–	2,341	423
Unidentified	–	–	–	418	1,655	407	111	1,770	1,766	2,596
Totals	10,597	–	8,958	418	15,300	863	10,497	1,770	45,332	3,051
APCs & IFVs										
BMPs	2,934	–	1,551	237	1,580	–	2,602	194	8,668	431
BTR-60PB	3,410	–	2,703	40	2,105	43	2,597	177	10,815	260
Others	456	–	1,170	165	6,151	153	4,587	255	12,364	573
Totals	6,800	–	5,424	442	9,838	196	9,787	626	31,847	1,264
Artillery										
122mm towed	1,902	–	1,894	745	3,765	533	3,144	205	10,705	1,483
122mm SP	384	–	126	–	14	–	–	–	–	–
130mm towed	276	–	402	23	720	400	485	45	1,883	468
152mm towed	138	–	708	160	1,546	345	1,178	93	3,570	598
152mm SP	324	–	54	–	21	–	9	–	408	–
180mm towed	?	–	48	–	105	–	72	–	225	–
Unidentified	–	–	–	839	–	2,863	–	1,336	–	5,083
Totals	3,024	–	3,232	1,767	6,171	4,141	4,888	1,679	17,315	7,587
MRLs	630	–	646	–	1,040	–	1,052	–	3,368	–
AT weapons										
85mm + guns	306	–	1,124	–	2,654	–	2,383	–	6,467	–
SPG-9	366	–	759	–	1,599	–	811	–	3,535	–
RPG-7	7,173	–	7,562	–	18,064	–	13,488	–	46,287	–
ATGM BRDMs	549	–	522	–	1,542	–	1,198	–	3,811	–
Suitcase ATGM	366	–	369	–	1,008	–	814	–	2,557	–
Totals	8,760	–	10,336	–	24,867	–	18,694	–	62,677	–
SSMs										
FROG	124	–	120	–	240	–	180	–	664	–
Scud	132	–	72	–	177	–	89	–	470	–
Scaleboard	?	–	36	–	52	–	48	–	136	–
Totals	256+	–	228	–	469	–	317	–	1,270	–
AAA										
S-60	582	–	576	706	1,528	3,018	879	590	3,565	4,314
ZSU-57-2	–	–	128	–	277	34	31	–	436	34
ZSU-23-4	500	–	276	–	420	49	594	286	1,790	335
ZPU-4/ZU-23	280	–	400	280	1,153	58	512	244	2,345	582
Unidentified	–	–	–	849	–	2,765	–	1,222	–	4,736
Totals	1,362	–	1,380	1,835	3,378	5,924	2,016	2,242	8,136	10,001
SAMs										
SA-4	270	–	297	–	297	–	213	–	1,077	–

Estimated Soviet force inventories (early 1978) (continued)

	Groups of Forces		Western MDs		Central MDs		Eastern MDs		Totals	
	Units	Store	Units	Store	Units	Store	Units	Store	Units	Store
SAMs (Cont)										
SA-6	300	–	140	–	80	–	140	–	660	–
SA-7	4,125	–	3,864	–	8,618	–	6,693	–	23,306	–
SA-8	–	–	–	–	–	–	60	–	60	–
SA-9	496	–	84	–	40	–	170	–	790	–
Totals	5,191	–	4,385	–	9,035	–	7,282	–	25,893	–
Mortars										
82mm	–	–	162	–	270	–	–	–	432	–
120mm	1,079	–	1,224	190	3,012	22	2,184	120	7,499	332
240mm	–	–	48	–	48	–	61	–	157	–
Totals	1,079	–	1,434	190	3,330	22	2,245	120	8,088	332

1 While the estimates upon which the above table is based appear to be basically correct, certain points remain questionable: the complete absence of reserve stocks for anti-tank weapons, for example. The number of heavy tanks in service appears very high, as these vehicles were supposedly phased out by the early 1970s, and those listed may be other tanks. Many other figures also remain questionable but, despite the age of these estimates, they do provide a valid outline of Soviet strength.
2 The groups of forces include all units in Europe outside the USSR. Western MDs are the Baltic, Byelorussia and Carpathia MDs. Central MDs are the Leningrad, Moscow, Kiev, Odessa, North Caucasus, Transcaucasus, Turkestan, Volga and Ural MDs. Eastern MDs include the Central Asia, Siberia, Transbaikal and Far East MDs, plus Soviet Forces, Mongolia.

Estimated Soviet tank inventory (mid-1970s)

Group of Soviet Forces Germany: 4,025 T-64/72, 2,030 T-62, 2,040 T-54/55
Northern Group of Forces: 650 T-62
Central Group of Forces: some T-64/72, 1,150 T-62, 180 T-54/55
Southern Group of Forces: some T-64/72, 1,140 T-62, 170 T-54/55
Total Groups of Forces: 11,380+ tanks – 4,020+ T-64/72, 4,920 T-62, 2,440 T-54/55
Western Military Districts: 3,610 T-64/72, 2,400 T-62, 3,800 T-54/55
Rest of USSR: 2,110 T-64/72, 8,750 T-62, 11,785 T-54/55
Tanks stored and in war reserve throughout USSR: 12,000 all types
Total tanks: 43,885 with units, 12,000 reserve.

By the early to mid-1980s Soviet tank strength was about 55,000: 21,000 T-54/55s, 14,000 T-62s, 6,000 T-64s, 1,000 T-64Bs, 12,000 T-72s, 1,000 T-80s. 1988 *Military Balance* figures were 9,500 T-54/55s, 13,700 T-62s, 9,300 T-64s, 8,500 T-72s, 2,300 T-80s.

perceive Soviet equipment policy as a mirror of a Western model.

The use of training weapons makes it difficult to determine which weapons are front-line equipment. Thus photographs of M-30 howitzers being towed by MT-LBs in

Soviet arms production for export (1972–83)

	Total production	Exported
Tanks	35,000	6,650
BMPs and BMDs	32,300	2,300
BTRs and MT-LBs	18,500	4,450
BRDMs	12,400	2,370
SP howitzers	9,200	775
ZSUs	3,550	1,650

1 All figures DIA estimates. **2** Export figures do not include older vehicles, which are often supplied from stockpiles (these include 8,625 tanks). **3** Export deliveries do not include Warsaw Pact countries.

Soviet/Warsaw Pact tank production (×100) (1978–82)

	1978	1979	1980	1981	1982
T-55	5/8	5/8	0/5	0/5	0/5
T-64	10/0	10/0	8/0	2/0	0/0
T-72	15/0	20/0	20/0	14/0.2	20/1
T-80	0/0	few/0	3/0	4/0	5/0

1 All figures DIA estimates. **2** First figure is Soviet production, second is Czech and Polish.

the Leningrad Military District do not provide any clue as to whether they are front-line equipment or simply being used to train the MT-LB drivers to tow guns cross-country. While the simplicity of most Soviet equipment and the similarity of the basic, one-task performance required of most soldiers makes the use of training weapons possible, this does not, for example, explain the continued use of the FROG-3, which is very different from the FROG-7 and so of limited training use. The only really open source for the type of weaponry still in service with the Soviet Army is often photographs in Soviet publications, and these will sometimes show weapons that should have been retired long ago. The Soviets normally confine in-depth, open-source publicity to about two dozen "showpiece" divisions and a number of regiments from each military district or group of forces.

The differences in readiness categories (by the late 1980s the Soviets described units as either "ready", referring to Categories I and II, or "unready") and weaponry had a direct impact on the mobilisations for the real or threatened invasions of Hungary in 1956, Czechoslovakia in 1968, Afghanistan in 1979 and Poland in 1980–81. The divisions that actually crossed the border (or threatened to) were, apart from the paratroopers, largely Category II or III formations. In many cases their intended first-category reservists had already discharged their legal obligation in the pre-invasion call-ups carried out in order to exert diplomatic pressure, and had to be replaced by lower categories, further complicating the process. In all the invasions the troops had orders to use the minimum force necessary (which soon rose to war levels in Hungary and Afghanistan).

Soviet Army weapons production (× 1,000)

	1978	1979	1980	1981	1982	1983	1984
Tanks	3.0	3.5	3.1	2.0	2.5	2.7	3.2
APCs	1.6	1.9	1.9	1.0	0.6	0.5	7.5
IFVs	2.8	2.6	3.2	3.2	3.3	3.4	3.3
Artillery (towed)	1.4	1.5	1.4	1.6	1.7	1.7	1.6
Artillery (SP)	1.0	0.8	0.6	0.7	0.7	0.75	1.0
Reconnaissance vehicles	1.1	1.2	1.2	1.0	0.7	0.7	0.5
ATGMs	35.0	40.0	45.0	60.0	62.5	70.0	70.0
Radars	1.0	1.0	0.9	0.9	0.8	0.9	1.0
SAMs	53.0	53.0	53.0	53.0	53.0	52.0	52.0
Helicopters	0.65	0.75	0.75	0.75	0.75	0.8	0.8
MRLs	0.55	0.6	0.7	0.7	0.7	0.7	0.6
AAA (SP)	0.2	0.1	0.3	0.3	0.2	0.1	0.05

1 All figures are DIA estimates. **2** Except for ATGMs, exports, are excluded. **3** IFV figures may include BTRs.

Chapter Four

The offensive

"The offensive is the basic form of combat action. Only by a resolute offensive conducted at a high tempo and to a great depth is total destruction of the enemy achieved."

GENERAL V.G. REZNICHENKO

The Soviet offensive has its origins in the offensive thought of the Czarist Army, in the fast-moving cavalry forces of the Russian Civil War and Russo-Polish War, and it was highly developed in the decade 1926–36. Much of this was wiped away by the purges, and the Army that met the *Wehrmacht* in 1941 was inadequate both in weapons and tactics. However, the hastily improvised mass army soon rectified these failings and provided today's Soviet Army with the basis of its offensive thinking, which has been constantly refined and updated since 1945. Soviet operational thought still depends heavily on wartime experience. Yet they are aware that, in the words of Marshal Sokolovskiy, ". . . it is extremely dangerous to attempt to carry over methods of armed combat worked out during the Second World War into contemporary conditions without making some changes."

That victory comes only from the attack is recognised by all armies, and since the 1920s the Soviet Union has evolved its strategy, operations, tactics and technology towards the offensive. Surrounded as they are by what they perceive as hostile capitalist states and potentially unreliable allies, the nightmare of a world in arms against them has been a "worst case" for military planning from the founding of the Soviet Union. The impression the Second World War made on Soviet society as a whole – which cannot be underestimated – was compounded by the Cold War. The Soviets *will not* lose a war, for defeat must mean massacre and enslavement or, at very least, the overthrow of everything painstakingly built since 1917. The Soviets intend to win, and they intend to win quickly in a war fought off the soil of the Soviet Union. The way to do that is to attack quickly and relentlessly, using mechanised combined-arms forces with the emphasis on tanks. The end of war is victory. All else is nonsense.

Current Soviet offensive thought reflects two realities: the importance of nuclear, biological and chemical (NBC) weapons and the increased lethality of modern weaponry brought about by technological innovation, including the use of anti-tank guided missiles (ATGMs) and precision-guided munitions (PGMs).

A major function of the improved Soviet weapons and tactics is to raise the nuclear threshold by pre-empting both the NATO nuclear release decision and the mechanisms by which the decisions would be executed. The independent air operation, OMGs, *spetsnaz*, chemical weapons, heliborne forces, long-range artillery and conventional SSMs are all primarily to destroy NATO's nuclear weapons, delivery systems and attendant headquarters, communications links and targeting facilities. Even if it had the will, NATO would then be unable to escalate to theatre nuclear war. If the longer-ranged theatre nuclear systems such as the F-111F were used, the Soviets could retaliate with larger numbers of Backfires and Fencers.

Soviet tactics are optimised for a battlefield where NBC weapons are in use or liable to be used at any time. The Soviets apparently believe that a future war will probably begin with a conventional phase. While the war could continue without the use of NBC weapons, they believe it likely that the "forces of aggressive capitalism", if losing, will resort to NBC weapons. If the Soviets believe such a strike is likely, they will pre-empt it by using their own NBC weapons. Similarly, if the Soviets are not winning a conventional conflict, they may initiate the use of NBC weapons to restore what they consider to be favourable conditions for their offensive. That, like the fact that tactics or weapons unworkable in nuclear war have no place on the modern battlefield, is a certainty that no number of policy declarations can wish away.

But the Soviets keep their options open. Before 1967 a war against NATO in which no NBC weapons were used was impossible. Today it is conceivable. But the view expressed in US Army tactical and operational-level manuals, that the conventional mode of operations will prevail and that NBC conditions can be seen as a special case, may well be wishful thinking. Soviet military thought and weapons design have addressed the problems of fighting under NBC conditions in a much more realistic manner than those of any other army.

Many of the Soviet innovations that contributed to the improved conventional war-fighting capabilities of the late 1970s and early 1980s are equally applicable to the use of

nuclear weapons as an integral part of operations and tactics. The SS-21 surface-to-surface missile and new heavy artillery can deliver nuclear weapons with precision, while operational manoeuvre groups and air assault brigades and battalions are well suited to the exploitation of nuclear strikes. Nuclear delivery systems are today better integrated into the Soviet Army force structure than they were in the days of nuclear pre-eminence. The Soviet Army can now fight a war with nuclear weapons, instead of operating in "broken back" conditions after an initial overwhelming strike.

The increased lethality of modern conventional weapons has threatened the armoured offensive that is at the heart of the Soviet operational art. The 1973 Middle East War, underlining the results of a long series of studies, tests and manoeuvres, showed that new weapons, especially ATGMs, could destroy tanks, BMPs and APCs at greater ranges and quicker than ever before. Technological innovations such as laser rangefinders for tanks and computerised fire-control systems for artillery have made these existing weapons systems more effective than in the past. Throughout modern warfare the development of new weapons technology, whether the Minie rifle, the machine gun or the ATGM, has given the concealed and camouflaged defenders more of an advantage than the moving and exposed attackers. This is the lesson learned by Grant's Army of the Potomac at Cold Harbor, by Haig's British Expeditionary Force on the Somme, and Mandler's tanks in Sinai. It is a lesson that the Soviets, who place more emphasis on the study of military history than any Western army, know very well. The Soviets have met the challenge posed by the new weapons, and have evolved their tactics to maintain their validity in the face of such weapons. In addition to developing new tactics for existing weapons, technological innovations – such as compound armour – are being introduced to maintain the combined-arms offensive.

New technologies are changing the face of warfare. As they did when encountering similar dramatic changes in the 19th and earlier 20th centuries, the Russians look to the acquisition of foreign technology as a means of keeping up. While some of the most obvious recent examples of the Soviet military use of Western high technology, usually stolen, have been in air (the radar of the MiG-29 Fulcrum, the engine of the SS-N-21 cruise missile) or naval systems (sonobuoys), the practice now appears to be spreading on a large scale to ground forces systems also. As a result, the Soviets may well field their counterparts of Western "reconnaissance-strike complexes", using the same technology, in the near future.

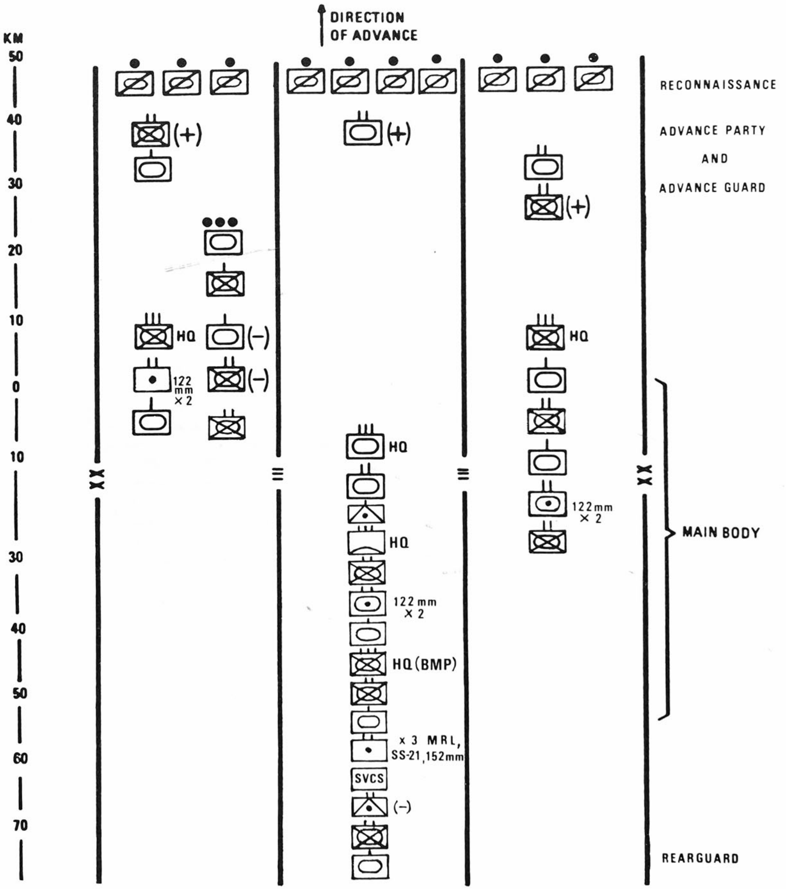
The Soviets expect the technological revolution to have a great impact on the battlefield. Marshal Ogarkov, as Chief of Staff, was an especially strong proponent of this view. The trend towards increased conventional lethality, which originated in the 1960s, is likely to become more significant as modern systems – especially those defined by the Soviets as strike-reconnaissance complexes – present new capabilities. Guided munitions that give area weapons the ability to kill tanks are among the most important innovations. The Soviets see the development of this technology as an attempt by the United States to alter the correlation of conventional forces in Europe.

The need to come to grips with new technology has also been a primary driving force, through Ogarkov and the General Staff in 1976–83, in the development of Soviet operations, tactics and hardware. The Soviets have developed their operational and tactical thinking to make their forces less vulnerable to both nuclear and high-lethality conventional weapons. This has contributed to the continued emphasis on surprise, speed and shock rather than deep echeloning and numerical superiority.

The need to locate and pre-emptively strike enemy nuclear weapons, their targeting assets and the headquarters that control them has always been a Soviet priority. What they seek is to be able to defeat such targets without themselves using nuclear weapons. In recent years the same has become true of high-technology, high-lethality conventional systems, whose neutralisation has also had a major influence on the evolution of Soviet operations, tactics and hardware since the mid-1970s.

The Soviets envisage the modern battlefield as lacking a continuous front, with dispersed forces, open flanks and large gaps between units. They would probably initiate the use of NBC weapons to keep the offensive moving, but this will not of itself guarantee a mobile, decisive situation. The large number of nuclear warheads available to either side will make it difficult to concentrate the forces needed to achieve or, more important, to exploit a breakthrough and then keep it supplied in the face of nuclear interdiction of the supply routes. There is no guarantee that even nuclear warfare will be decisive. Modern conventional weapons, especially in the terrain of West Germany, allow overlapping fields of fire across any potential avenues of advance. In the 1973 Middle East war the Syrian front's terrain and force densities did not allow breakthroughs and mobile combat, even during the first days when the Syrians had a large numerical superiority. The Israeli counter-offensive, though successful, had much more limited objectives, and thus a slower rate of advance, than one in Europe. Even in Sinai there were long periods when the fighting could not be described as mobile. Force densities in West Germany will be greater than those in the Middle East, and sophisticated sensors and reconnaissance will reduce the chances of surprise and infiltration. If the Soviet offensive does not achieve success in the first week of fighting, logistic problems, spurred by high ammunition expenditure, may help to bring the offensive to a halt in static warfare, the very war of attrition the Soviets reject so emphatically. Despite these limitations the Soviets are also prepared for a long war. Given either numerical

MARCH FORMATION OF ADVANCING MOTORISED RIFLE DIVISION



Notes: 1 The division is marching on four routes with three regiments up. The left-hand motorised rifle regiment has been allocated two routes. 2 Flank patrols and local security detachments are not shown. 3 Engineer route-opening detachments (OODs) will accompany march security elements on each route. 4 Forward detachments, *reydy* and long-range reconnaissance patrols are not shown. 5 Divisional 122mm battalions are part of RAGs. 6 BMP regiment has detached its artillery battalion to the Forward Tank regiment. 7 Air defence assets distributed through formation.

superiority or surprise, the Soviet Army should be victorious in Europe. The offensive's strengths outweigh its drawbacks.

The Soviets have always planned to sustain the high rates of advance they demand by continuous offensive operations, attacking by day and night. This is very different from simply a night operations capability. There has never been an example in history of an army that carried out continuous offensive combat, but the Soviets envisage fighting at such intensity for up to 30 days, possibly longer. Whether they could actually perform as claimed is uncertain, but the fact remains that the Soviet Army is oriented towards continuous combat operations.

The Soviets recognise three basic forms of offensive action: the meeting engagement, the breakthrough attack, and the pursuit. The meeting engagement involves attacking the enemy while both sides are on the move; the breakthrough attack is directed against an enemy defending in place; pursuit is an attack against an enemy attempting to move away. Attacks in any situation can be made directly from the march, or with hasty or deliberate preparations. All three forms of offensive action incorporate the basic Soviet operational principles throughout.

From the march to the assault

The Soviet offensive depends on the transition from the march to the attack. Units manoeuvre in march order and fight in combat order. Soviet march formations and dispositions are standardised to allow units to attack from the march while maintaining momentum.

Although capable of cross-country movement, each Soviet unit will advance along a road whenever possible. During the 1968 invasion of Czechoslovakia the Soviet forces stuck mainly to the roads, which were badly cut up by tracked vehicles, limiting their subsequent use by supply trucks. This was repeated in the initial stages of the Afghanistan invasion. Throughout that war Soviet forces have been largely confined to roads. The roadbound nature of Soviet performance in these invasions contrasts with their willingness to use secondary and unpaved roads on exercises in Russia and eastern Europe.

Battalions always stay on one route, regiments one or two, and a division has up to four parallel routes in its sector, which ranges from 20–40km when not in contact with the enemy to 10km when delivering divisional attacks. This type of march formation is needed to meet the Soviet demand for rapid advance: 70-100km a day in nuclear conditions, 25-35km a day in conventional warfare, maintaining this rate through action in the enemy rear, an emphasis on hasty attacks, and the good cross-country mobility, amphibious capability and obstacle-crossing ability of Soviet vehicles. The average speed of a combined-arms unit on the march is 30–40km/hr, and two-thirds of that at night or in bad weather. Vehicle spacing is 15–50m on roads, 50–100m cross-country.

In front of the parallel advancing columns are the reconnaissance screens; patrols from the divisional reconnaissance battalion are a full day's march, up to 50–100km, ahead of the division's main body. Patrols from the regimental reconnaissance company are half a day's march – up to 20–50km – ahead of their regiments, spread over the 10–15km regimental sector. Beyond these are the *desants*, forward detachments, *reydy*, and long-range reconnaissance patrols (q.v.)

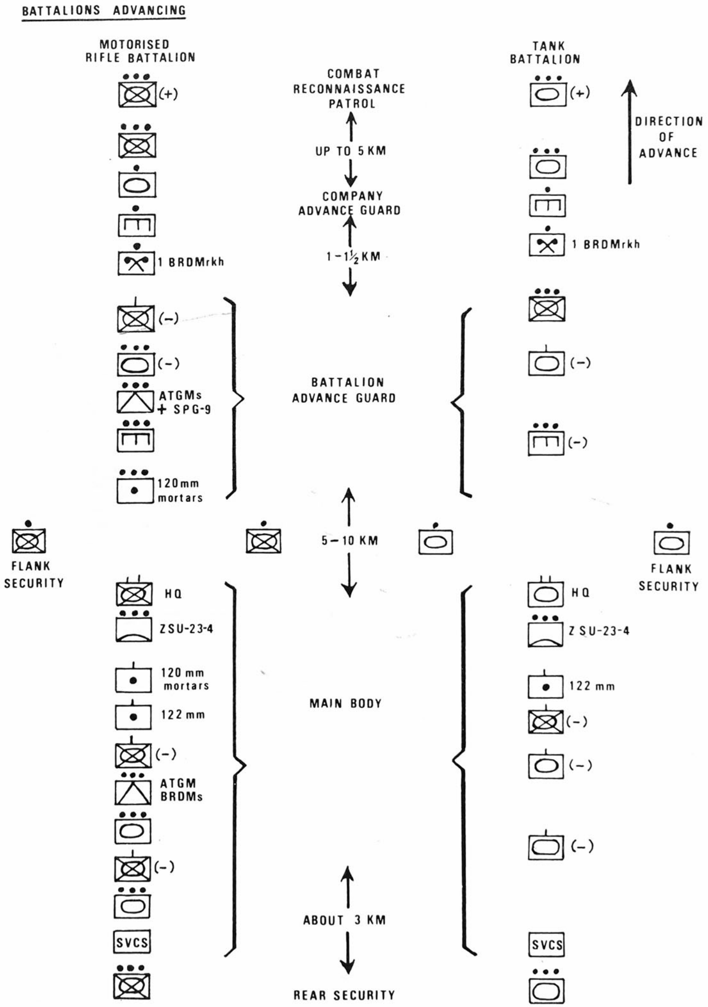
Leading the main body on each route of advance is the advance guard, a combined-arms force normally equal to a third of the total force, which precedes the main body by five to ten kilometres in a battalion column and 15–30km in a regimental column. A division may, in some situations, send out a full regiment as its advance guard. The main body follows the advance guard, protected by flank and rearguard detachments, platoons in a regimental column, squads in a battalion column. A regimental column can stretch 28–50km, making traffic control and command direction vital. Battalion commanders usually travel in their BRDM or tank-mounted forward headquarters with the battalion's advance guard company; regimental commanders will move up to their advance guard battalion if they believe that action will develop. Any battalion is supposed to be able to operate independently for 5–15h 20–30km from the rest of the regiment.

The advance guard

The advance guard itself is divided into a number of parts. Its forward "point" element is the combat reconnaissance patrol. A motorised rifle unit, whether a battalion or regiment, will have a combat reconnaissance patrol consisting of a motorised rifle platoon, half a platoon of tanks, and a squad of engineers or an NBC-reconnaissance BRDM.

In a motorised rifle battalion column this patrol will be followed by the rest of the advance guard, 5–10km behind it. This force will probably consist of the other two platoons and headquarters of the motorised rifle company, the remainder of the tank and engineer platoons, half of the battalion 120mm mortars, and attachments from regimental heavy weapons, especially SO-122 or D-30 regimental howitzers and ZSU-23-4s and SA-9 launchers for air defence, as well as additional engineer support. From this force the company commander will usually form a second combat reconnaissance patrol, identical in composition to the first, which will precede the rest of the company by 1,500–1,000m.

In a regimental column the combat reconnaissance



Notes: 1 The artillery battery is often increased to a battalion. 2 The rear security platoon is often only a single vehicle. 3 This diagram shows battalions advancing either as a regimental advance guard or on an independent route of advance.

patrol is supported by the advance party, which can provide additional firepower or extricate it from a difficult situation. The advance party is actually the advance guard of the battalion that is, in turn, serving as the main body of its regiment's advance guard. Regiments send out reinforced battalions as advance guards and these battlions, in turn, send out reinforced companies which are simultaneously the battlion's advance guard and the regiment's advance party. The rest of the battalion, regardless of whether it is being employed as a regimental advance guard or is in its own column, follows 5-10km behind this company, except for one platoon, which is dispersed for march security and deploys one squad on each flank as flank guards and another squad or platoon 3,000m behind the battalion as a rearguard. A regimental column will use platoons instead of squads for flank security parties. Tank units advance in the same way as motorised rifle units, although the proportions of tank and motorised rifle units are, of course, reversed.

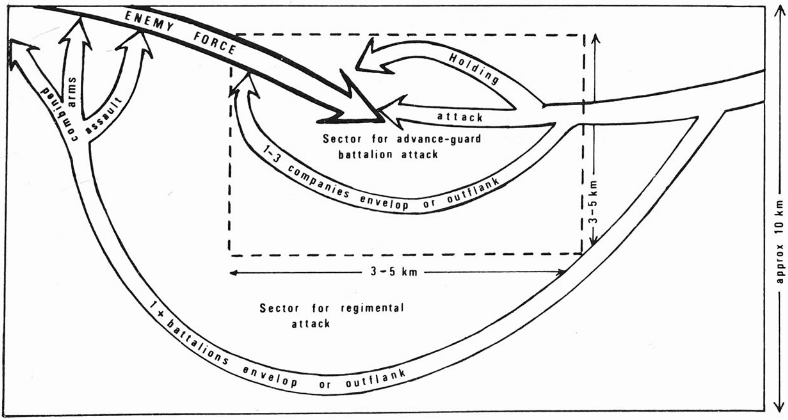
The advance guard, with all its component elements, has the task of either eliminating opposition that might impede the advance of the main body or of fighting independently until the main body arrives if the enemy is too strong to be defeated by the advance guard alone. The reinforcement of advance guard units with additional weapons is intended to allow them to fight independently, clearing opposition away so that the main body is not forced to deploy and thus avoiding slowing down the advance. The advance guard clears away enemy patrols, screens and security detachments. In a regimental column the advance party can possibly defeat light opposition without the need for the rest of the advance guard to deploy or fight.

The meeting engagement

The meeting engagement is the most important form of offensive action in the Soviet view. The advance guard of a Soviet unit will attack upon encountering the enemy, seize the initiative, penetrate the enemy covering forces, and pin down the enemy main body while simultaneously covering the deployment of the Soviet main body, which will attempt to envelop or outflank the enemy. The Soviets will fully exploit the cross-country mobility of their vehicles and their willingness to take advantage of any path or track to carry out their outflanking or enveloping manoeuvres. Failing that, advance guard and main body will assault together. It is a tall order, but the Soviets claim that their meeting engagement tactics give them the capability to "with bold decisive action, fix and destroy any force we come in contact with on the battlefield."

Theoretically, a Soviet unit should not blunder into enemy units, as it will have been preceded in its advance by reconnaissance patrols. The first element of the advance guard to encounter the enemy will probably be the combat reconnaissance patrol, which will report the contact to the advance guard commander with as much information on the tactical situation and enemy dispositions as possible. The combat reconnaissance patrol may engage the enemy,

THE MEETING ENGAGEMENT



attempting to get them to reveal their positions, but its main task is to look for routes with which to envelop or outflank the enemy force, and to observe.

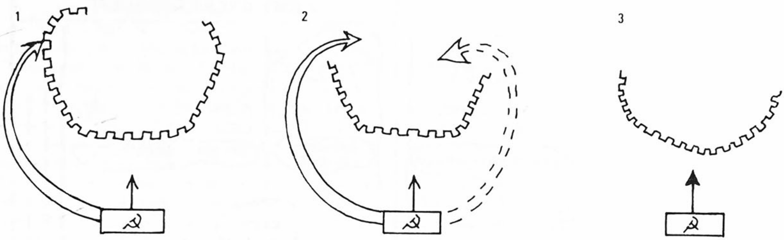
In 10–30min, depending on spacing and road conditions, the combat reconnaissance patrol will be reinforced by the remainder of its company, functioning as battalion advance guard. This force will advance at maximum speed to develop the situation and seize and hold positions until the arrival of the rest of the advance guard. However, if the advance guard commander, on the basis of information which he is receiving, decides that the enemy is weak enough to be defeated by the company or that more information is required, he may order a probing attack. One platoon and the artillery and mortars will go into overwatch positions while the remainder of the force advances on a 400m frontage with a formation depth of about 200m, making maximum use of cover. The tanks lead, moving singly 100m apart and 100m ahead of the APCs or BMPs, which will move in pairs. If engaged, they will either keep going, trying to infiltrate or find a way around the enemy, or will attempt a hasty company assault. Alternatively, they may retire under the cover of fire from the overwatching platoons and up to 60 rounds of HE from the howitzers or mortars.

If no probing attack is ordered, if the probing attack was unsuccessful, or if the attack was forced to retire, the company will hold its positions in a hasty defence until the battalion comes up, 20–30min after the company arrived on the scene. The battalion commander, and possibly artillery battalion and even regimental commanders, will all close up in their BRDMs and issue orders to the battalion. It will normally attempt to outflank or envelop the enemy, but if this is not possible it may be launched into a full-scale hasty attack from the march or an attack from the march. The difference between the two is that in the hasty attack directly from the march, companies are fed directly into battle as they arrive, whereas in the attack from the march they are first deployed along the line of departure before attacking. There is much less time to plan, bring up units and co-ordinate fire support in the hasty attack from the march. Whatever type of attack is used, co-ordination of forces and artillery support will, if necessary, be sacrificed to achieve surprise, speed or shock. The Soviets realise that any time to deploy and co-ordinate their forces before the attack, however brief, can reduce losses and increase results. However, speed of reaction is seen as vital in the meeting engagement. The side which first gains the initiative through rapid and aggressive action will probably win, despite limited knowledge of enemy strengths and dispositions. Soviet attack plans are prepared in great detail. Planning time is usually 60–180min for a divisional attack, 30–150min for a regimental attack, and 20–45min for a battalion attack. Total time for mounting an attack when already in contact, from receipt of orders to H-Hour, is 2–4h for a division, 1–3h for a regiment, and 25–60min for a battalion. The Soviets try to minimise these times by the use of computers and parallel planning. In the hasty attack directly from the march, fire support will be limited to whatever over-watching tanks or artillery can be positioned to give direct fire, although mortars are sometimes used in the indirect-fire role in such attacks. A hastily prepared attack may be co-ordinated with an artillery offensive of 10–20min, and the guns will normally not be allowed to expend more than 80% of a Unit of Fire of ammunition. The advance guard will then deliver a combined-arms assault against the enemy.

If the attack by the advance guard is successful, the main body does not deploy but continues its advance. If the advance guard is unable to defeat the enemy, it will still continue to probe and hold the enemy until the main body comes up and deploys. If required, the advance guard may have to assume a hasty defensive posture and, if the enemy attacks, the main body may be forced to join the defence and call upon the second echelon to resume the offensive.

If the main body attacks, it will normally attempt an envelopment or flank attack while the advance guard holds the enemy in position, although frontal assaults will be made when there is no alternative, or the advance guard alone may deliver a front holding attack. The Soviets believe that the threat of nuclear weapons will keep the enemy dispersed enough to make it feasible to bypass, envelop and encircle him in mobile combat. They will accept larger gaps between formations at operational level than at tactical level. Envelopments and flank attacks (envelopments go wider around the enemy) depend heavily on effective route reconnaissance, knowledge of enemy dispositions and command initiative. It will take 60–90min for the main body of a regiment to come up, and the Soviets will use this time to position artillery. Both direct and indirect artillery fire will support a regimental attack with an artillery offensive lasting from 10–20min to 30–40min. The time also gives the artillery an opportunity to perform target acquisition, and allows Soviet commanders (whose use of forward command posts means they will be on the scene when decisions must be made) time to obtain and analyse reconnaissance information and co-ordinate the attack with other forces. Parallel columns may be directed to join in an envelopment or flank attack. Multiple axes will be employed whenever some of the potential opposition is weaker – units or national forces less able to fight than those on either flank – and any resulting penetrations used to prevent lateral redeployment. The attack will then be launched as a combined-arms assault. Once the enemy has been defeated the pursuit will begin. If the enemy has not been defeated, the second echelon will come up to keep the pressure on, for the high tempo upon which the Soviets insist means that there will be no breathing space for their opponents between the different phases of the meeting engagement. However, it is through

TYPES OF MANOEUVRE



1 *Okhrat.* Flanking manoeuvre, may be performed alone or together with a frontal attack or an envelopment. **2** *Obkhod.* Envelopment, can be single or double. Can be carried out in conjunction with a frontal or flank attack. **3** *Frontal attack.* The least favoured type of Soviet offensive action. Normally carried out in conjunction with other manoeuvres or when there is no alternative.

manoeuvre, rather than the combined-arms assaults, that the Soviets hope to achieve success in the meeting engagement.

The Soviets believe meeting engagements to be crucial in both nuclear and conventional situations, and devote a large proportion of their unit tactical training to them. In NBC conditions these weapons will often create a gap that both sides will attempt to fill simultaneously. The Soviets believe that modern mechanised warfare will result in mobile warfare, and that meeting engagements, rather than breakthrough attacks, will predominate.

The strengths and weaknesses of all Soviet offensive tactics apply to the meeting engagement, their emphasis on speed and manoeuvre and the tendency towards stereotyped manoeuvres and drill-type actions, especially when small units are forced to act independently. The enemy may outmanoeuvre them in the very way the Soviets hope to outmanoeuvre their enemy. Similarly, "bold manoeuvre" against unascertained opposition is, in the face of modern anti-tank weapons, liable to result in rapid and heavy losses. Soviet meeting engagement tactics also leave them vulnerable to the same flank attacks or envelopment that they hope to executive, although their well drilled attack from the march and the great depths of their march columns give the Soviets a capability to deal with such attacks. In such situations it will be command, control and communications that determine how quickly and effectively a unit will be able to respond to a threat.

The first battles of the next war in Europe will probably not be massive breakthrough attacks of deeply echeloned forces, but meeting engagements with Soviet advance guards, forward detachments, *desants* or *reydy*.

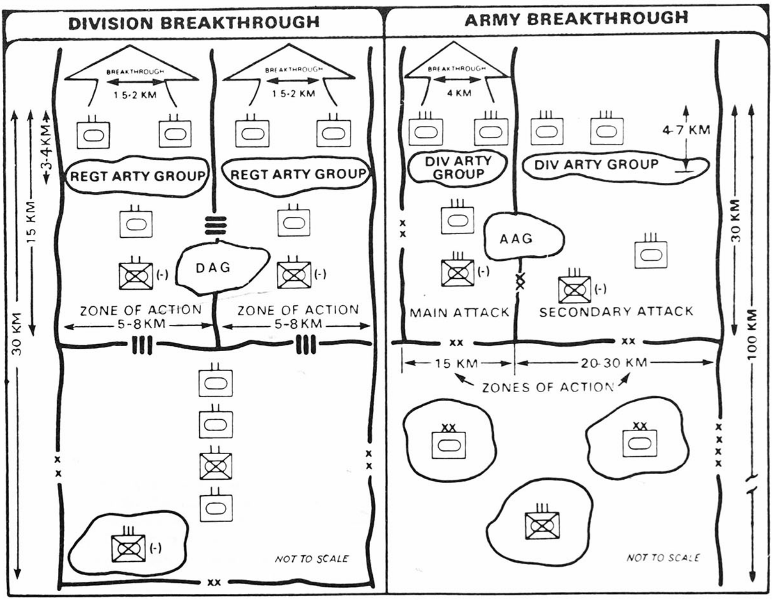
The breakthrough attack

The breakthrough attack is made whenever the enemy is already in defensive positions, even if they are makeshift defences. Such positions will be bypassed or neutralised whenever possible, but when the breakthrough attack has to be made, its aim will be the defeat of the enemy and the penetration of his positions. This will lead to mobile battles, characterised by meeting engagements, through the depths of the enemy defences and rear areas, a phase that will end (theoretically) in the encirclement or destruction of the enemy and the pursuit of any survivors. If the Soviets do not use nuclear strikes to breach enemy defences they will first bypass all possible resistance, aiming to destroy nuclear-capable systems and headquarters and cut their lines of communication, blocking counterattacks in mobile combat. Once the penetration is secure, follow-on echelons or mobile groups will exploit or reduce bypassed enemy forces.

Breakthrough attacks can include hasty attacks and deliberate attacks, and are made either from the march or from contact. The difference between the types of attack lies in the time available to plan, co-ordinate and bring up supplies, mainly artillery ammunition. The greater the time spent preparing the attack, however, the greater the time the enemy has to prepare his defences. The Soviets will not become bogged down in large-scale attacks on every strongpoint. Rapid conventional fire strikes will be matched with a high tempo of operations even in the course of a breakthrough operation.

The preparation time for an attack varies according to the size of the Soviet forces, the strength of the enemy, and

BREAKTHROUGH ATTACK DEPLOYMENTS (TANK UNITS)



the overall situation. A full divisional attack can be mounted in as little as 2–4h, and a regimental breakthrough attack can be planned in the standard 60–90min it takes to come up and deploy. However, a breakthrough attack from contact against prepared defences might take several days of planning and stockpiling. Nuclear or chemical strikes may reduce the need for a build-up before the attack.

The breakthrough attack from the march takes place whenever advancing Soviet columns encounter a defending enemy force that cannot be bypassed or neutralised. First, enemy outposts and screening forces must be cleared away by the advance guard or forward detachments. Soviet forces will also attempt to determine enemy dispositions and strengths. This may include a reconnaissance in force or a probing attack. Sometimes the entire advance guard will make a probing or holding attack, or even a full-scale assault, before the main body moves up. If the advance guard can break through, the main body will not deploy, but will move directly to exploit the breakthrough. If reconnaissance shows that an assault by the advance guard alone is unlikely to succeed, it will engage the enemy at longer range, halt out of contact or assume a hasty defensive posture until the main body arrives. The advance guard will then join in a combined-arms assault, remain in overwatch positions or deliver a holding attack while the main body attempts to envelop or outflank the enemy position. The Soviets will not attempt to attack directly off the line of march against any but the weakest defences. In the breakthrough attack the advancing Soviet units will move from their assembly areas to the line of departure and attack from there. Artillery support has a much higher value in the breakthrough attack than in the meeting engagement, and such attacks will be co-ordinated with an artillery offensive of from ten to forty minutes' duration.

The breakthrough attack from contact occurs when the Soviet offensive has been halted for a considerable period of time – normally several days – and is being resumed opposite established enemy defences. The standard Soviet offensive of the Second World War, with its precisely drafted plans and hub-to-hub deployment of artillery, was

the breakthrough attack from contact, which is now seen as the exception in modern warfare.

A 3–1 overall advantage has been considered required for a breakthrough, with 3 to 5–1 in tanks, 6 to 8–1 in artillery and 4 to 5–1 in troops being the post-war norms. Clearly, this sort of concentration would make a vulnerable target. Thus the Soviets have emphasised "force multipliers" such as surprise, the use of smoke, and chemical weapons.

The distances between the assembly areas and the line of departure are much shorter in the breakthrough attack from contact than in any other offensive manoeuvre. Units will often jump off from front-line positions. Surprise is therefore harder to achieve, and the large troop concentrations make inviting targets. Consequently elaborate ruses, night deployment of troops, and intense security measures are as much the hallmarks of the breakthrough attack from contact as the thorough reconnaissance and detailed plans, usually drafted at army level or above, that the Soviets consider necessary for victory in these attacks.

Breakthrough attacks from contact are co-ordinated with the most intense artillery offensives, lasting from 25 to 40min and using large quantities of ammunition brought forward during the preparation period. Air strikes will also be used in conjunction with the breakthrough attack from contact, as will tactical parachute drops and helicopter troop insertions behind the enemy position. When they have a clear numerical advantage the Soviets will use multiple narrow penetrations against an enemy cordon defence. When the enemy is defending in more depth, or when the Soviets have less superiority, there will be fewer but larger penetrations, with the attacking forces echeloned in depth to maintain momentum. The Soviets also believe that breakthrough attacks from contact will often involve a river crossing, a difficult but not impossible combat task.

Whether conditions are nuclear or non-nuclear, the Soviets will try to concentrate and manoeuvre firepower rather than troops. This has led to the recent increase in emphasis on helicopters, long-range artillery and multiple rocket launchers, which can concentrate their fire on a decisive point and then follow the advance through the enemy defence.

The pursuit

Pursuits can be frontal, parallel or, preferably, a combination of both. Basically, a frontal pursuit is an attempt to engage from the front and break through the enemy rearguard. A parallel pursuit uses a parallel route to cut the enemy off. If both types of pursuit can be combined, with one Soviet force as the hammer and the other as the anvil, the retreat route will be cut and the trapped enemy forces annihilated. Any breakout attempts will be halted by the blocking force.

Soviet units will pursue after a successful attack, or when an enemy is seen to be withdrawing. The Soviets realise that command control is vital but difficult in a fast-moving pursuit. They must co-ordinate separate forces, including forward detachments and heliborne units, to block retreat routes and take advantage of a quickly changing situation. Whenever possible the Soviets will plan for a pursuit even before making an attack; these plans may include pre-arranged air or artillery strikes on defiles or choke-points which may turn a retreat into a rout.

The frontal pursuing units will generally be the units which dislodged the enemy, and they will attempt to maintain uninterrupted contact with him, using combat reconnaissance patrols. Second-echelon units will be committed to the parallel pursuit. Artillery support is normally decentralised, with artillery battalions attached down to the leading pursuing battalions.

Offensive operations

Soviet operations are aimed at the destruction not only of opposing armed forces but of opposing states. The theatre operation is sub-divided into the nuclear, air, ground forces, naval, airborne and air defence operations. All of these are multi-service in nature. For example, the ground forces operation will include Air Force units. The theatre operation may include 3–5 fronts, plus elements of the Navy, Air Force and Strategic Rocket Forces. Ultimate objectives may lie at a depth of 1,200–1,800km, and it may last up to 25–30 days. In Europe the Channel would probably be the final objective, the Ruhr or the Rhine the intermediate one.

The nuclear operation was originally seen as a massive strike which would not only pre-empt retaliation but would pave the way for all subsequent operations. Before 1967 and the re-emphasis of conventional capability, a theatre operation without a nuclear operation would have been unlikely. The 1981 Soviet "no first use" declaration may indicate that a nuclear operation could precede a theatre operation in order to pre-empt enemy use of nuclear weapons. Otherwise, the Soviets continue to see a future war as opening with a conventional phase. The nuclear operation will be planned and ordered at Supreme High Command level.

The air operation is designed to achieve the aims of the nuclear operation, but under conventional conditions. Air power is seen as the most effective way to attack targets in the depths of the defence. The air operation is intended to destroy enemy aircraft on the ground and in air combat, airfields, especially nuclear-capable ones, and command and communications centres. It will normally – but not inevitably – be conducted throughout the depth of a

theatre of operations. It is not limited to the Air Force (although the Soviets do recognise an Air Force-only version, the independent air operation), and will probably include Army, Navy and possibly Strategic Rocket Forces units as well. The air operation will be made even more effective by the increased capability of Army conventional surface-to-surface missiles and – a feature of many Soviet exercises – special forces and airborne attacks on airfields and headquarters.

The air operation, under TVD command, may strike up to 1,200km deep, last 24–36h and precede the opening of the ground force operation by a similar period. Following the start of the ground operation, the air forces could be used under frontal command for "air accompaniment", much as artillery used for preparation passes from higher to lower command as the troops cross the line of departure.

The air operation will usually be in three echelons. The first echelon will be used primarily for pre-emption, hitting headquarters, and air defence suppression. It will include about 25–30% Frontal Aviation and 5% strategic sorties. The main strike echelon will follow, comprising about 60% Frontal and 25% strategic sorties. This will be followed by the reserve strike echelon, which will complete the destruction of any targets left by the main strike echelon. This may lead to two or three large-scale air strikes on the first day of the operation and one or two on each succeeding day. Intensive electronic warfare efforts will support the air operation.

The air operation's primary goal remains the destruction of nuclear capability: SSMs, dual-capable aircraft, nuclear storage sites, and their associated headquarters and communications links. After that, enemy air forces and SAMs, with their command and control, will be targeted. Air operations are by no means limited to the opening days of a war but will also precede offensives during the course of a conflict.

In the late 1970s the US Defence Intelligence Agency (DIA) estimated that the Soviets could have 85% of their forward-area tactical aircraft available for an air operation at the start of a conflict. Fighters and fighter-bombers can fly up to five sorties a day each in a surge, decreasing to three a day over a longer period. A number of aircraft – estimated at 80–200 – may be held back in readiness for the delivery of nuclear weapons.

The air defence operation combines the theatre's air defence assets under a single plan, itself a part of that for the theatre offensive. It is by no means limited to interceptors and SAMs. Frontal Aviation, SSMs, *Spetsnaz* and artillery would play a part, as in the air operation.

The air defence operation defends against both the pre-emptive attacks and strikes during the course of the operation. The Soviets have learned the lessons of the 1967 Middle East War, and would avoid the fate of the Arab forces in that conflict by mounting an effective defence against a surprise attack on their air assets. Air defence will be in two operational echelons or belts. The first, up to 300–500km behind the FEBA, will be made up mainly of air defence assets at front and lower levels, supplemented by Warsaw Pact national air defence forces, both integrated at national and TVD level. The second, up to 700–1,100km behind the FEBA, will consist primarily of Soviet *Voiska* PVO forces. As Warsaw Pact forces advance westwards, the "first echelon" air defences will displace forward, any resulting gaps being filled by the deployment of additional assets.

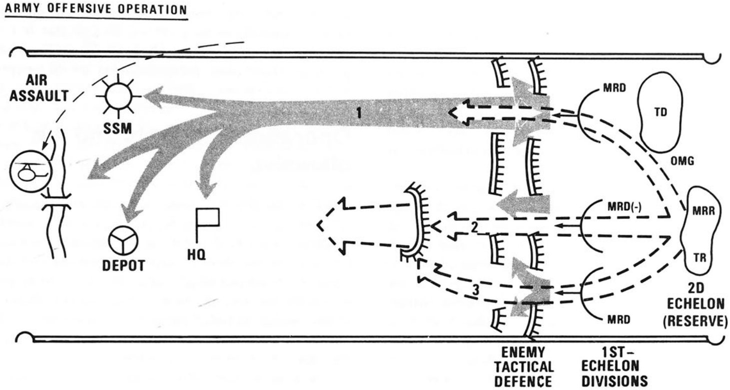
Much like the air operation, the theatre airborne operation is part of "operations in depth". It includes the seizing of operational-level objectives by air-inserted forces in conjunction with *Spetsnaz* and forces in place. Some of the aspects of this type of operation were seen in Prague in 1968 and Kabul in 1979. Political and military headquarters, communications centres, chokepoints, airfields, ports, bridges and weapons storage areas are potential targets.

The naval operation supports the theatre offensive, destroying nuclear-capable naval forces in the first instance and blocking seaborne lines of communication in the second. The amphibious operation carries out the same missions.

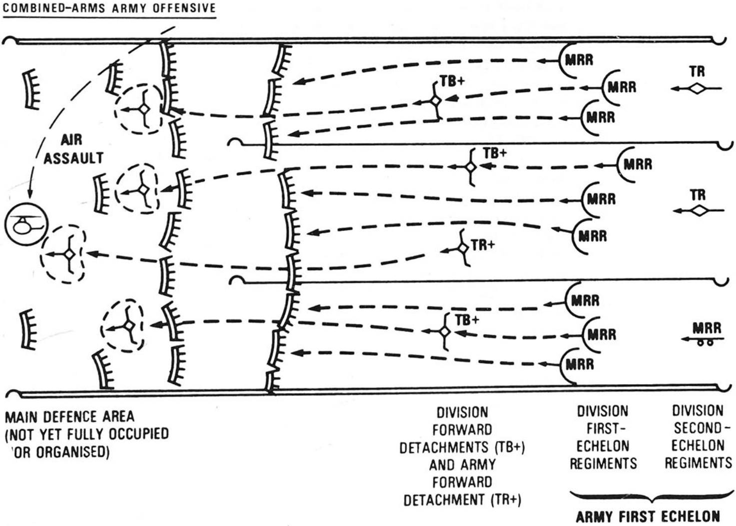
The ground forces operation in a theatre offensive will probably consist of two successive front operations. Like all such operations, the objective may be expressed in geographical terms but the goal is victory through the destruction of the enemy's military or political forces. The operation will strike deep, hitting capitals and population centres in an effort to bring about the collapse of an enemy already weakened by Soviet "active measures". Such is the increased Soviet emphasis on surprise, it may be that a front would deploy a single echelon of armies for the initial attack, hoping that this would serve to create an early victory, pre-empt nuclear use, and place forces on enemy territory. The armies themselves could also deploy in one echelon with a reserve, or in multiple echelons. Operational manoeuvre groups (OMGs) and forward detachments would be used against initial objectives 40km distant, aided by air assault operations by forces of up to brigade size. A front operation may involve three or four combined armies plus one or more tank armies. A front could consist of 10–25 divisions, up to 8–10 of which may be tank divisions; 180+ SAM launchers; 4,000–5,100 artillery pieces (including mortars); and 3,000–7,500 tanks.

The commitment of the second echelon – when there is one – is a key element of Soviet operational art. If the mission of the second echelon is to be penetration, it must move forward, even though this will increase its vulnerability. The second of the two successive front operations is the one that goes to the final objective.

Nuclear weapons can be part of the ground forces operation. Divisions, armies and fronts all have nuclear-



The Soviet army offensive can take a variety of forms. The combined-arms army depicted here – comprising three motorised rifle divisions, a tank division and an independent tank regiment on a frontage of about 60km – could put in its main attack on axis 1 or axis 3, with a supporting attack on axis 2. Depending on the army's mission and the development of the battle, the second echelon could be used to maintain the momentum on axis 3, secure OMG lines of communication on axis 1, or exploit success on axis 2. *(US Army)*



In this variation on the combined-arms army offensive, forward detachments are being used in surprise attacks to forestall organisation of the defence. **TB:** tank battalion. **TR:** tank regiment. **MRR:** motorised-rifle regiment. *(US Army)*

capable missiles and artillery. These systems, along with Frontal Aviation, will be used to deliver nuclear weapons within 250km of the FEBA. The Strategic Rocket Forces and TVD-level aircraft will attack more distant targets; population and most industry will not be targeted. Again, the emphasis will be on mass, surprise and destruction of enemy headquarters, target acquisition means, communications systems and, especially, nuclear-capable weapons.

The operational manoeuvre group is one answer to the problems posed by the need for a quick victory in Europe under either conventional or nuclear conditions. Used in the Second World War, when they were termed "mobile groups," OMGs are independent formations which may be as small as an independent brigade or as large as several divisions. Division-sized OMGs are likely to be part of each front or even army. Their re-emergence in the early 1980s apparently stemmed from exercise experience rather than a continued application of wartime lessons. Indeed, in the early 1980s OMGs had become so operationally significant that there was criticism within the Warsaw Pact that they were being included in exercises whether they were needed or not.

OMGs are intended to achieve objectives in the operational depths of the enemy's defences. They are by no means solely exploitation forces, and frequently serve as an advance guard in mobile combat. They can be used with the army or front deployed in either one or two echelons. A deployment of one echelon and an OMG has been suggested as probable in a future conflict in Europe. The OMG may be committed once the first echelon has gained its objectives – the first echelon making the penetration and the OMG exploiting – or before a penetration is achieved.

Once committed, the OMG penetrates the defences, seizing key political and military objectives and defeating reserves. Much as tactical units use their forward detachments and *reydy* as "keys" to unlock the defence, operational formations will use their OMGs. The army-level OMG appears to be based usually on a tank division. It may be reinforced by units which include an air assault brigade, a helicopter regiment, an army artillery group, reconnaissance and intelligence units, air defence units, engineer units, command and control elements, one or more motorised rifle regiments, and a number of fixed-wing aircraft.

Generally, an OMG will initially deploy about 40–60km behind the FEBA. It can be used to reinforce the first echelon, become or join the second echelon, be placed in reserve, or be employed as an OMG. It can be as much as 20–30% the size of the parent organisation, further increasing its flexibility of employment.

In spite of the development of the OMG concept, the question remains: is the Soviet Army really able to carry out deep operations? Some American analysts point to Zapad-81 and other exercises to show that the Soviets are at least training to acquire this ability. But it is still uncertain how much of the threat is real and how much potential. How broad and significant is this disparity?

Operational thought and the offensive

Given strategic surprise, the many improvements to its conventional war-fighting capability give the Soviet high command a good chance of a quick, non-nuclear victory. In the European theatre, improved weapons and tactics could maintain the high tempo of attack which, in the words of Colonel Vasiliy Savkin, "may lead to a disruption of the mobilisation deployment of the enemy army, of the massing of forces necessary for a successful defence, and of the approach of reserves from other continents."

The 1981 nuclear no-first-use declaration and improvements in conventional war-fighting capabilities has not undercut the primacy of nuclear weapons in the Soviet view. Because a modern war can become nuclear at any time, all Soviet tactics remain nuclear tactics. Marshal Nikolai Ogarkov's 1984 disparagement of the feasibility of a disarming first strike or of limited nuclear war is consistent with the 1981 declaration.

To prevent NATO from re-adjusting effectively to nuclear warfare, the Soviets aim to destroy nuclear weapons, delivery systems, headquarters and communication links; disperse attacking forces; make multiple, deep penetrations; and get large forces deep into Germany as quickly as possible. Only if they failed in this would they seek to switch to a theatre nuclear conflict.

In the Soviet view the best way to prevent nuclear escalation is to achieve a quick victory by conventional means, which in turn requires speed in the offensive. The changes in Soviet operational and tactical thinking and in hardware seen since the mid–1970s are largely directed at achieving this goal.

If mobility is vital to tactics, it is perhaps even more crucial to operations. Speed is seen as being of the essence in moving forces from the Soviet Union to the forward area and on the battlefield, and in disengaging, shifting and concentrating. This type of operationally significant mobility is expected to increase the tempo of combat by comparison with that of the Second World War.

The Soviets aim to fragment the enemy by destroying headquarters and communications or by radio-electronic combat. They will also frame their battlefield operations in an effort to knock out specific members of NATO. They may also believe that the psychological effects of conventional theatre operations – particularly those resulting from the use of forces such as *Spetsnaz*, heliborne *desants* and chemical weapons – could be strong enough to

permit operational goals to be achieved without decisive battle. Even if they do not precipitate a military or political collapse, these effects could certainly push the Western governments into militarily incorrect decisions.

The Soviets believe that a future war in Europe, China or South Asia will be decided not by the sum total of weapons or tactics, but at operational level. They are well aware that in the Second World War their tactics were never as good as those of the Germans. Soviet weapons, while excellent and of serviceable design, were seldom able to triumph on the battlefield through technological superiority alone. It was Soviet operational art that surrounded Stalingrad, defended Kursk and destroyed Army Group Centre. The quality and weapons of German units really did not matter, once they had been encircled by the Soviets. The emphasis on the operational level of war means that any limitations suffered by weapons and tactics are of secondary importance. Soviet weapons and tactics and the men who use them do not have to be the best in the world. They do not even have to be as good as those of their opponents. They simply have to be adequate for the execution of Soviet operational-level actions.

The increased emphasis on the operational level may be in part a reaction to improvements in NATO weapons and tactics. The Soviets, who would find it difficult to make their weapons and tactics superior to those of NATO, have apparently decided not to match Western improvements but to trump them by looking to operations that will, if successful, make irrelevant any superiority. The answer to a good tank is not necessarily a better tank. The solution may lie instead in a raiding force across the tank's supply route, or a missile on the tank's headquarters, or spraying the tank with nerve agent in its vehicle park, or, best of all, using the full capabilities of the Soviet state to make the tank's owners refrain from using it at all. The abundance of resources devoted to the Soviet military – 12–15% of GNP, year after year – will eventually yield results even in an economy as inefficient as that of the USSR. This means that the Soviet Army is certain eventually to acquire the forces needed to generate the new operational capabilities, while simultaneously modernising and improving existing forces.

In contrast with their tactics, the Soviet's operational science and art cannot be described as stereotyped. In the Second World War the Germans realised that while Soviet tactical commanders were usually amateurs, their operational-level commanders were worthy opponents, as Stalingrad, Kursk, Orel-Bryansk and the Destruction of Army Group Centre demonstrated. If much of Soviet tactical thinking can be seen as battle drills and terrain-dependent template deployments, then operational thinking is guided by the study of military history. As a result, it is much harder to predict the actions of a Soviet front commander than it is those of a battalion commander.

The current pre-eminence of the operational level appears to have flowed from the decision in the late 1960s to create armed forces capable of victory under any circumstances, whether all-conventional, theatre nuclear or strategic nuclear. This process was so far advanced by 1981 that Leonid Brezhnev felt able to make his "no nuclear first use" declaration. Manifestations of the policy included the building up of theatre nuclear forces and of intermediate command levels by, for instance, strengthening the capabilities of theatre headquarters.

In carrying out its operations the Soviet Army cannot now rely on a nuclear strike as a preparation. Instead it has the independent air operation and a wide range of chemical weapons. Army weapons have a longer reach, with attack helicopters, helicopter-inserted forces, conventionally armed missiles and heavy artillery now receiving increased emphasis.

Surprise is of vital importance in Soviet operational thinking. It is part of the solution to the threat posed by precision-guided munitions – including ATGMs – to the mechanised, combined-arms offensive. These weapons will not be able to stop the Soviet offensive if they are outflanked, outmanoeuvred, suppressed or destroyed while still in their *kasernes*.

In the 1970s Soviet logistics underwent a complete reappraisal, overhaul and modernisation. In addition, the changes in theatre command have helped streamline both logistics and combat command and control. The Soviet Army has 60–90 days of ammunition and 90 days of fuel pre-positioned in the forward areas, and has been increasing the logistical capability of its combat formations. Divisions are acquiring material support battalions, with armies and fronts getting brigades. These formations combine transport and logistics under a single commander. As a result, the logistics failures of the Czechoslovakia incursion were not repeated in the 1979 invasion of Afghanistan.

The Soviets no longer see in-depth echeloning – with division behind division, army behind army, front behind front – as mandatory. The sheer effort of mobilising and deploying the troops needed for this sort of density would rule out any possibility of surprise, as well as over-burdening the transport system. Moreover, there is unlikely to be enough time to build up and dump the supplies needed for such forces.

Operations in depth

Starting in the late 1960s and increasingly throughout the 1970s, the Soviets have been putting greater emphasis on operations that use surprise and manoeuvre to fight deep in the enemy positions, ahead of the march columns of the first-echelon divisions in both nuclear and conventional

operations. These operations include *reydy*, *desants*, forward detachments, long-range reconnaissance patrols and the whole range of operations in depth. The same concepts began to be applied to Soviet operational thought in the 1970s and 1980s. The basic goals and means are similar at both the operational and tactical level, although the two must not be confused.

These are not new and revolutionary tactics. *Glubokoi boi* ("operations in depth") were stressed by Marshal Tukhachevskii in the 1930s, and similar tactics were used in Eastern Europe and Manchuria in 1944–45.

The Soviets see operations in depth as relying on simultaneous suppression throughout the depths of the defence. The TVD command will integrate these strikes on the enemy's operational depths.

The application of these concepts shows both the similarities and the differences of operational and tactical thinking. Both are intended to facilitate victory – at operational level in a war, at the tactical level in a battle – in either conventional or nuclear combat. *Reydy*, *desants* and forward detachments can be used at either level of combat, although at the operational level the objectives lie deeper and the units are larger.

The "battle in depth" is the tactical counterpart of the "operation in depth." Termed "daring thrusts," or *reydovaya taktika*, in addition to the historical *glubokoi boi*, they depend upon mobile warfare for their success. In a static situation they would not be able to penetrate the enemy front lines except by helicopter or parachute. Nor could they use the surprise, manoeuvre and infiltration upon which these operations depend for success.

The Soviets could conceivably commit up to 30% of their forces forward of the first echelon as reconnaissance patrols, *desants*, *reydy*, forward detachments, advance guards and operational manoeuvre groups.

These different missions all have the same end, acting as the keys that unlock the stability of the enemy defence by attacking vital installations, especially headquarters and nuclear weapons, providing reconnaissance and target-acquisition data, lowering enemy morale, spreading confusion and disrupting enemy rear areas. Each of the different types of operation approaches these ends in a different way. Long-range reconnaissance patrols provide information and will attack critical targets once located. Forward detachments, ranging from companies to reinforced regiments in size, are assigned a specific task in the depths of the enemy's position, usually seizing and holding a terrain feature or objective to prevent the enemy from defending it and to help secure the passage of the main force. Once the forward detachment secures its objective, it holds this until relieved. *Reydy*, similar in size and scope to forward detachments, have a general reconnaissance-and-destroy mission, rather than one of taking and holding a specific objective, although they may be called upon to do this as well. *Reydy* missions are of indefinite length. *Desants*, normally airborne, heliborne or amphibious, are inserted behind the enemy rear to perform their missions, which are similar to those of either the *reydy* or the forward detachments. Similar to forward detachments are enveloping detachments or special detachments, each with a specific mission forward of the first echelon. Together, these operations will destroy the cohesion of the enemy defence and speed the Soviet advance. The emphasis the Soviets place on striking headquarters and communications centres is seen throughout their operational and tactical thought, but never more strongly than in the operations of these units. As priority targets they are second only to nuclear weapons: destroying the nerve centres of the enemy brings victory that much closer.

Successful fighting in the enemy's operational or tactical depths requires suppression of the defences throughout. This is why the increased emphasis on operations or battle in depth has been reflected by an increase in the availability of systems able to strike with conventional or nuclear weapons either the operational (Fencer aircraft and naval missiles) or the tactical depths (heavy artillery and helicopters).

Forward detachments range far ahead of the march columns, immediately behind the reconnaissance patrols. Of company, battalion or, rarely, regimental size, they are usually taken from units in the second echelon to avoid weakening forces in contact with the enemy, and will seize and hold important objectives, road junctions, defiles and bridgeheads until the main body arrives. They will also attack high-priority targets, especially headquarters and nuclear weapons. In defence, forward detachments conduct delaying actions in the security zone. Forward detachments co-operate and often link up with *desants* and may themselves be inserted by helicopter. Forward detachments would often be the first units to exploit the effects of nuclear weapons, moving to their objectives through gaps blown in enemy positions.

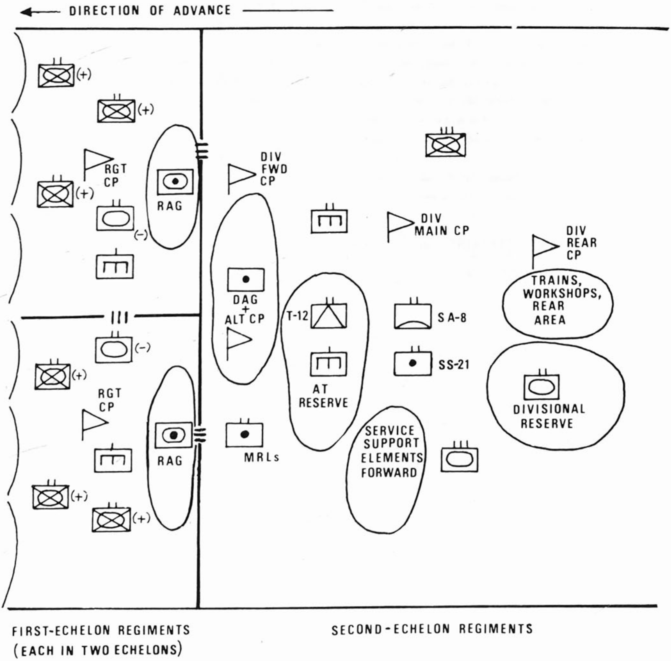
Reydy, of the same size and composition as forward detachments, also link up with *desants* and will operate immediately behind the reconnaissance patrols. They have no specific terrain objectives, but reconnoitre and attack targets of opportunity, and will avoid being engaged by superior enemy forces. The *reydy*, like the forward detachment, moves forward by using surprise, manoeuvre and infiltration. Also like forward detachments, *reydy* will mislead the enemy as to the position and direction of the overall Soviet advance. *Reydy* is different from the Western concept of hit-and-run raids, which operate from a base. The Soviets will also perform raids, but usually on a small scale and to collect intelligence data.

Long-range reconnaissance patrols and *desants* are normally performed by specialist reconnaissance or airborne units. The role of these tactics within the Soviet concept of operations in depth is considered in those sections of this book.

Forward detachments and *reydy* can be either tactical or operational in size or scope, the tactical missions usually involving units of company, battalion or, conceivably, regimental size. The operational missions may require units of regiment, division (at army level) or even corps (at front level) size. All will be supported by air power, especially helicopters, and will link up with airborne and heliborne *desants*. For longer or deeper missions, engineer and logistical elements will be provided. These forces not only exploit penetrations but act to clear the way for the first echelon and so may be in action before there is a penetration, though this will normally only occur if the enemy is weak or surprised.

Forward detachments and *reydy* are normally carried out by combined-arms forces. Any tank or motorised rifle unit can serve as a basis for these operations. One company in each regiment, usually the first, is specially trained to act as a forward detachment or *reydy*. BMP-equipped motorised rifle regiments and the independent tank battalions of motorised rifle divisions will frequently provide sub-units for these missions. The long Soviet debate on the proper use of the BMP in battle has established that the BMP, with its powerful armament and excellent cross-country mobility, is well suited to this role. BMP units, usually of company and battalion size, will be reinforced by tanks. The BMP-equipped motorised rifle regiment and the independent tank battalion are normally in the second echelon of motorised rifle divisions, so the act of detaching units from them will not weaken the troops in contact with the enemy.

TYPICAL DEPLOYMENT OF MOTORISED RIFLE DIVISION ON THE OFFENSIVE



Two-echelon deployment could include three regiments forward. Single-echelon deployment is also typical.

The combined-arms assault

The basic elements of tactics are fire and movement. Fire is how the enemy is defeated. Movement gains position to use fire. Fire without movement is indecisive. Movement without fire is likely to be disastrous. Soviet modern tactical theory adds "shock" to fire and movement, though fire remains predominant.

On the modern battlefield artillery can fire much more metal than any tank or infantry unit, but artillery fire itself cannot win a battle. For artillery to fight without tanks or infantry is indecisive, but in the Soviet view tanks or motorised rifle units may be called upon to fight without the full benefit of artillery, and should be made as self-sufficient as possible, with the ability to combine fire and movement. The means chosen by the Soviets to use these two elements of tactics in the attack is the combined-arms assault. It is an attempt to reconcile fire and movement with Soviet operational principles and the strengths and limitations peculiar to the Soviet Army and the weapons with which it fights.

The Soviets are willing to give up numerical superiority in exchange for surprise. "In a number of cases, one must deliver a strike even before the complete readiness of one's troops," says leading tactician Colonel V. Savkin, as "one thus obtains a larger effect." The inability to achieve surprise in Afghanistan has greatly limited Soviet battlefield success there.

The combined-arms assault is basically the same under all conditions, although there will be differences in each type of attack. In all types of attack, the Soviets stress reconnaissance, trying to locate the weak points or flanks that will normally be the targets of the attack. The attack will try to bypass strongpoints and strike rapidly through the depths of the enemy defence.

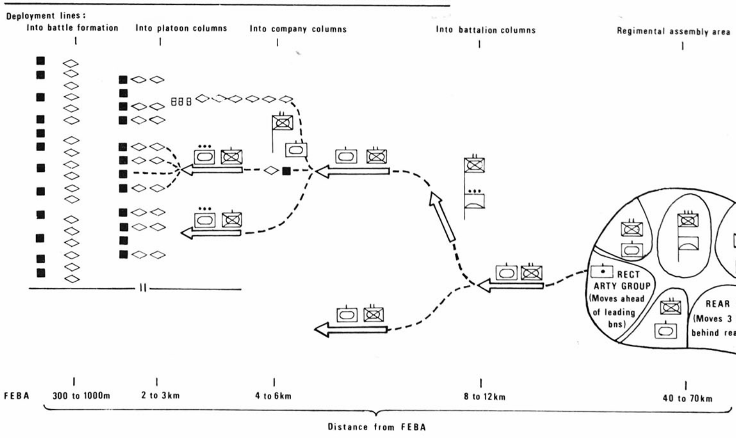
In the hasty attack made directly from the march there are no assembly areas; sub-units are fed in as they come up. In the breakthrough attack from contact, attacking units may jump off directly from the line of contact and will probably be deployed there under cover of darkness. Otherwise, assembly areas for a regimental attack may be 6–12km or more from the line of contact. Each regiment – sometimes each battalion – has its own assembly area.

The attacking units leave the assembly areas either in a regimental column or battalion columns. But when they are 8–12km from the enemy the attacking forces will be in battalion columns, their spacing and arrangement organised so that they will have space to deploy, and all the battalions will attack together.

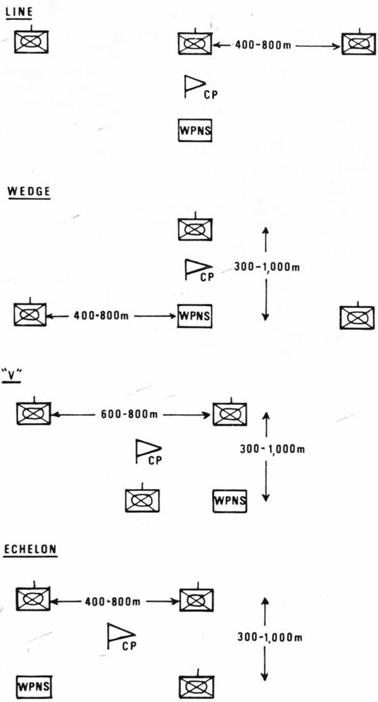
4–6km from the enemy, the Soviet battalion columns deploy into company columns. If one of the companies is to make up the battalion second echelon, it takes up the proper spacing behind the first echelon. Throughout the advance the Soviet artillery offensive will be hitting enemy defences, but if counterbattery fire has not silenced the enemy batteries the advancing Soviet units will probably be receiving indirect artillery fire.

Advancing at 15km/h, the company columns will deploy into platoon columns 1,500–4,000m from the enemy positions, depending upon the intensity of the fire.

MOTORISED RIFLE REGIMENT ATTACKING FROM ASSEMBLY AREA



BATTALION APPROACH MARCH FORMATIONS



The Soviets call march formation "pre-battle formation" and stress the ability to fight from it. These formations are alternatives to battalion march column and are all intended to allow quick deployment. The companies themselves may have their component platoons in columns or in line, wedge, "V" or echelon. Company depth is usually 300–600m.

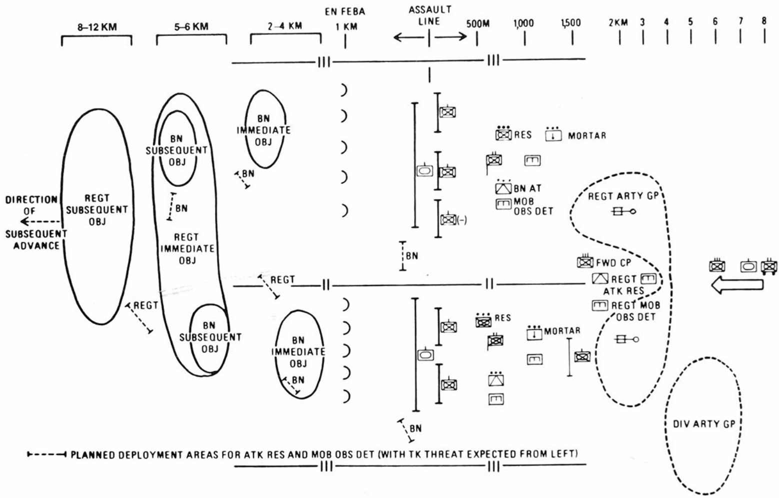
The heavier the resistance, the further away the Soviets will deploy. In a motorised rifle company the tank platoon column will lead the three motorised rifle platoon columns by 200m. If a motorised rifle platoon is attached to a tank company, it will follow the three tank platoon columns. Platoon columns are normally parallel but can form echelon, "V" or wedge.

Attacking units will normally traverse gaps in obstacles or minefields in platoon columns. Artillery fire may be used to clear gaps, and one tank per platoon will use KMT-4 or -5 mine ploughs and rollers. Combat engineer vehicles can use rocket-propelled explosive line charges to destroy mines and obstacles. If required, engineers will dismount and use bangalore torpedoes.

The platoon columns change formation into combat line about 1,500m from the enemy, although weak opposition may be overrun in platoon or even company columns to maintain momentum. The tank platoon leading each motorised rifle company will normally form its own combat line 150–200m ahead of the company combat line of APCs or BMPs. In rough, close or built-up terrain, when attacking at night or across a water obstacle, however, the APCs or BMPs will lead the tanks. Companies attack in a single echelon, usually line-abreast. Tank company combat lines are followed by any attached motorised infantry units. Air-defence elements will cover the assault from overwatch positions and the accompanying artillery, usually SO-122s but sometimes D-30s, will be 500–1,000m behind the combat line, using direct fire to shoot through the gaps between companies. The tanks will normally fire from the short halt, although they will fire on the move when suppression and speed are more important than accuracy or when they are close to the enemy position. The overall rate of advance while the motorised riflemen are still mounted is about 12km/h, about 200m/min. If the tanks fire from the move rather than from the short halt, the speed of the advance is increased to 15km/h. The speed of advance is especially important when artillery "fire strikes" are used to suppress the defence. If the attacking forces are advancing at 15km/h, and keeping to the minimum safety separation, they can be on top of the enemy before effective resistance can start. If the advance is following a rolling barrage, it is unlikely that a rate of more than 6km/h can be achieved.

Motorised rifle units remain mounted throughout the combined-arms assault only if the defenders have been effectively neutralised by NBC or conventional fire. In such a case the APCs or BMPs will overrun the enemy position and keep going, leaving the enemy to be mopped up by the second echelon, or the motorised riflemen will dismount behind the enemy position. The Soviets originally intended this as standard tactics in the combined-arms assault before they realised that modern weaponry would inflict heavy losses against such an attack. Today it is uncertain when the Soviets will attack mounted and when they will attack dismounted. The prevailing view seems to be close to that of Lt Cols V. Pishakov and L. Kirpach, who wrote: "A battalion normally breaks through the enemy's defences on foot, as modern defences can field many anti-tank weapons and engineer obstacles, which are greatly resistant to suppressive fire of all types. It is hardly reasonable to assume that all these will be suppressed. Those left undamaged will be able to inflict heavy losses on the BMPs." However, Col. L. Raminsky

MOTORISED RIFLE REGIMENT IN THE ATTACK



ATK RES = anti-tank reserve; TK = tank; MOB OBS DET = engineer obstacle detachment.

qualified this: "At times in exercises, commanders try to dismount troops even when there is no necessity. This does not answer a requirement of the Ministry of Defence." The apparent official line, as expounded by Col Gen V. Merimskii, Deputy Chief of Combat Training, is that the decision on how to attack should be made by the regimental or higher unit commander on the spot, as only he can judge battlefield conditions.

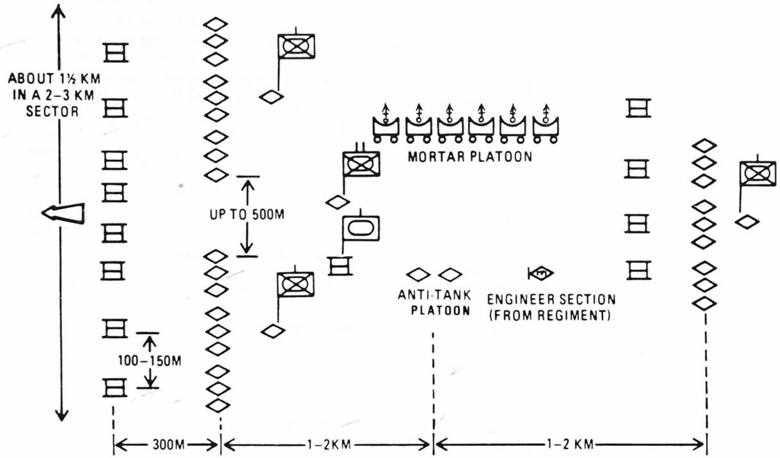
While the dismounted attack remains the standard Soviet tactic, in Exercise Zapad-81 a battalion-sized force of BMPs and T-72s supported by 122mm SP howitzers attacked with the troops mounted in the BMPs. Intense conventional firepower was used to suppress and blind throughout the depths of the defences. This appears to have been successful, allowing a quick breakthrough. Exercise Kavkaz-85 is reported to have applied these lessons on a larger scale, using fire strikes through the depths of the defence to permit high-speed mounted attacks by larger formations.

When the enemy defence is unsuppressed, strong in armour-killing weapons or in well prepared positions, or if the terrain is dense, built-up, close or otherwise unsuitable for rapid vehicle movement, the motorised riflemen will dismount, in defilade if possible, 500–1,000m or farther from their objectives and advance with the tanks from there. In this situation, the motorised riflemen will often ride in on the backs of tanks, in traditional Soviet fashion. If the terrain is completely unsuitable, the tanks will stay back to provide supporting fire with the APCs or BMPs and the motorised riflemen will deliver the attack on foot alone, as is often the case in Afghanistan, where the up-slope attacks have needed additional firepower from helicopters or, when possible, heliborne forces inserted on the objective.

The new requirement for operations throughout the operational and tactical depths is matched by a corresponding emphasis on offensive chemical weapons which can provide the simultaneous strike throughout the defence required by operations in depth.

Normally, the motorised riflemen will dismount when the combat line of BMPs or APCs is 300–400m away from the enemy. While the tanks press on regardless towards the enemy, the motorised riflemen form up into dismounted skirmish lines and advance with the APCs or BMPs following 300–400m behind them, firing from the short halt through the gaps between motorised rifle squads in the

MOTORISED RIFLE BATTALION IN THE ATTACK (MOUNTED)



If the battalion were attacking in a single echelon, the second-echelon company would be in line with the other two. If a reserve was formed, a platoon would be detached from a company. Often the second-echelon company leads the assault. The mortar platoon may deploy in the position shown, parallel to the enemy. BMP-equipped battlions have no anti-tank platoon. BMPs or APCs are 50–100m apart. Air defence assets would be with the companies. Company-level use can be made of AGS-17s or 12.7mm MGs, usually in direct support.

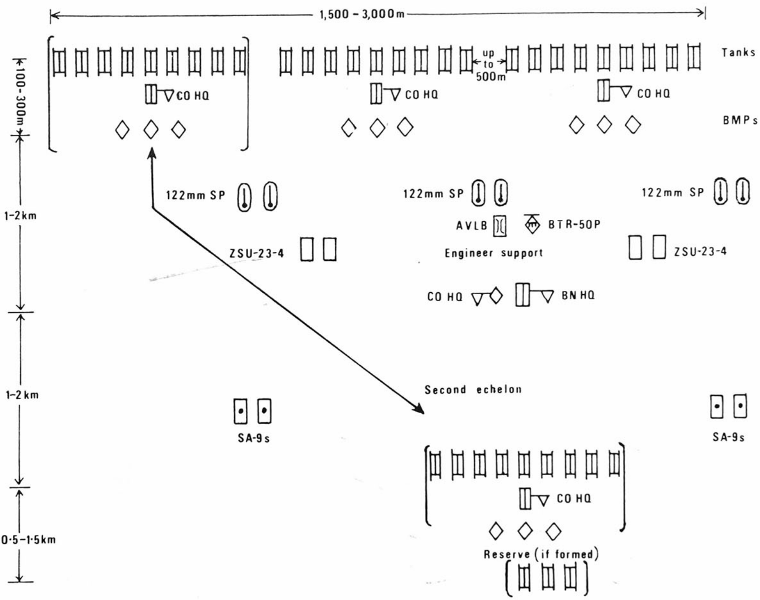
skirmish line. The accompanying artillery will join in this fire. When the tanks are 100–200m from the enemy positions, the Soviet artillery offensive, which has shifted to enemy front-line positions when the tanks entered direct-fire range, lifts. Direct-fire artillery and supporting fire from overwatching units will continue until they too endanger the attacking tanks. The Soviets realise that the defenders will be able to start using their weapons two or three minutes after the artillery fire lifts, and therefore insist that the tanks must enter the enemy position within this time, with the supporting motorised riflemen not more than 200m behind, giving suppressive fire with their infantry weapons and followed by the APCs or BMPs and the accompanying artillery.

Each dismounted platoon or company will attack in a single skirmish line, each component squad in an identical formation. Such an attack will suffer heavy losses unless the defenders are suppressed by fire from the tanks, BMPs or APCs, and the foot soldiers' own marching fire. If the skirmish lines are forced to ground, platoons will alternately fire and advance by short rushes until the assault line is reached. The Soviets will try to keep the skirmish lines moving if at all possible, however, not only to maintain the speed of the assault, but to prevent the tanks from being left unsupported. The tanks, already attacking at close range, should theoretically suppress the defences long enough for the motorised riflemen to gain the assault line, 25–30m from the enemy foxholes. At this point the motorised riflemen raise the traditional Russian battlecry, "Urra!", and charge with grenades and automatic fire.

If the attack is successful the Soviets will try to keep moving through the depths of the defences, remounting the motorised riflemen. The second echelon will reduce any pockets of resistance and mop up bypassed positions. Enemy counter-attacks at this stage of the assault will probably take the form of meeting engagements, and a mobile battle will result, widening the penetration for exploitation by successive echelons. Forward detachments will be sent into the gap, moving deep into the enemy position. If the attack is halted or repulsed the surviving units will take up the hasty defence to secure the line they are holding as the new line of assault for the second echelon to move through and resume the attack.

While the combined-arms assault can be highly effective, it also has the potential to fail spectacularly. It requires a high level of co-ordination of forces. By reducing

REINFORCED TANK BATTALION IN THE ATTACK



Alternative positions for the third company are shown, depending on whether the battalion is attacking in one or two echelons. If a reserve is formed, a platoon will be detached from one of the companies. The battalion has been reinforced by a motorised rifle company, an artillery battery, and engineer and air-defence weapons. Even if allocated a larger sector, the battalion will attack on a 1,000–1,500m frontage where possible. Tanks are 50–100m apart. In the attack, battalions are often reinforced by a full artillery battalion.

the complexities of tactics to battle drill and through intense and repetitive peacetime field training, the Soviets hope to make all the elements of the assault work together as parts of a well oiled machine. Inevitably, however, the reality of Soviet offensive tactics does not always correspond with the textbook ideal. For example, Soviet writings have observed that, under fire, there is a tendency for the spacings between different combat lines – the tanks, the dismounted motorised riflemen, the APCs or BMPs and the accompanying artillery – to spread out, losing mutual support. Similarly, if the timing between the lifting of the artillery fire on the enemy forward positions and the moment the attacking tanks hit the position is not precise, the enemy will have time to emerge from shelter and defeat the tanks after the shellfire stops. Conversely, if the tanks have advanced too quickly they may have to attack through friendly fire.

As the timing must be prearranged before the attacking units jump off, any delays owing to enemy resistance or terrain will not be reflected in the artillery offensive, although radio or flare signals could be used to control the fire under some conditions. The increased need for the motorised riflemen to assault dismounted has made co-ordination even harder. It is easier to control and manoeuvre infantry when they are in vehicles than it is when they are on foot. Dismounted attacks also make it harder for the Soviets to achieve the high rates of advance they demand. A single unsuppressed machine gun

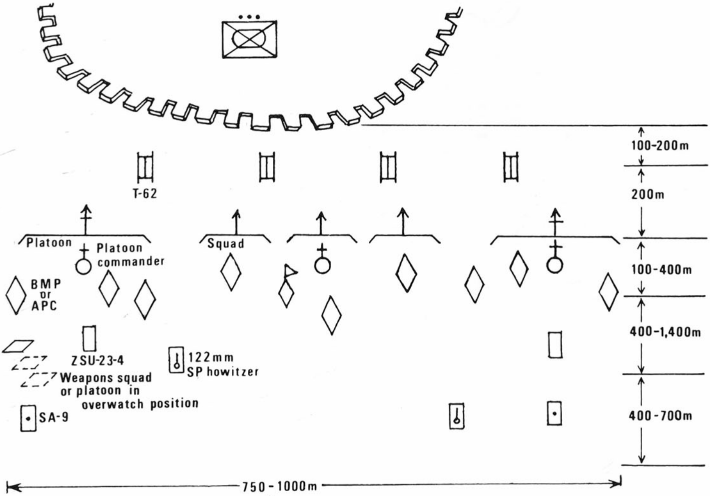
delivering enfilading fire can destroy an entire battalion advancing in a long, straight, Soviet-style skirmish line. If the motorised riflemen are pinned down, the tanks must either slow down – hardly a valid choice when confronted with anti-tank weapons and without the suppressive fire of the motorised riflemen – or they can drive, unsupported, into the enemy position, where they cannot do much harm to well dug-in defenders and are at the mercy of anyone who pops out of a foxhole with a LAW or similar hand-held anti-tank weapon.

Simplicity and a battle-drill approach to tactics may serve the Soviets well in an NBC environment. The effect of the resulting shock, losses and disruption of communications has been likened to that of suddenly committing to the Arctic incomplete units of troops trained at the equator. In such a situation, simple, well drilled tactics have the best chance of being effective. The Soviets have largely reduced company and platoon-level offensive tactics to a series of geometrical formations. All the battlion commander need do is indicate when these formations are to change and the company and platoon commanders supervise the changes. Plans are made at regiment, and the sub-unit commanders have been replaced wherever possible as the dominant element in tactics by the tactical system of well rehearsed formation changes. This is perhaps necessitated by the relatively low level of technical and tactical skill that still prevails amongst Soviet junior officers, NCOs and enlisted men. It is unrealistic to expect the personnel of a mass conscript army to have the expertise of those in long-serving professional forces, and the differences between the Soviet and the Anglo-American tactical systems reflect this.

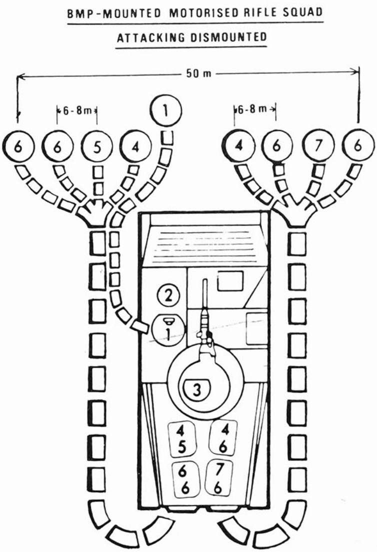
The decision to strengthen the battalion level of command probably results not only from acceptance of the fact that the battalion can operate as an integral force even if command and communications links are disrupted, but also from the general raising of Soviet tactical skill levels, which allows battalions to use initiative and creative tactics. A corresponding emphasis on decentralisation and tactical manoeuvre has been seen in the 1980s in exercises and on the battlefield in Afghanistan.

Though the officers may be inadequate and inflexible by

MOTORISED RIFLE COMPANY MAKING COMBINED-ARMS ASSAULT



This diagram represents the moment at which Soviet artillery fire against a defending enemy platoon strongpoint is lifted, and shows the spacing between different elements of the attacking force.



After the squad has dismounted the BMP follows 100–400m behind. Squad members are 6–8m apart laterally. **1** Squad (platoon) commander, AKMS-armed. **2** Driver. **3** Gunner. **4** PKM gunner. **5** RPG-7 (when mounted, this soldier is armed with an AKMS). **6** AKMS-armed rifleman. **7** SA-7 gunner, sniper (both also use AKMS) or rifleman. In the BMP-2, both dismounting patterns and squad armament differ.

Western standards (and sometimes even by their own), their skills are adequate for much of the Soviet way of war. Soviet companies are used in a similar way to Anglo-American platoons. Although capable of being divided, a company, like a platoon, will normally fight as a unit. An entire company will normally move or fire, rather than combining the two. Similarly, the platoons of a Soviet company will usually all be in the same formation. Soviet battalions have less flexibility than British company combat teams, but are similar to some other Western companies. All of a Soviet battalion will usually fight within visual contact of the battalion commander in his forward post. While he may command a powerful combined-arms force, the Soviet battalion commander's task is to execute orders prepared at regiment or higher level. While Soviet sub-unit commanders will usually not be called upon to act independently in the combined-arms assault, they will have to do so when their sub-unit is used as a combat reconnaissance patrol, a forward detachment or an enveloping force. It is in such actions, rather than the combined-arms offensive, that any weakness and inflexibility in the Soviet tactical structure will be most evident. It has certainly been evident in Afghanistan.

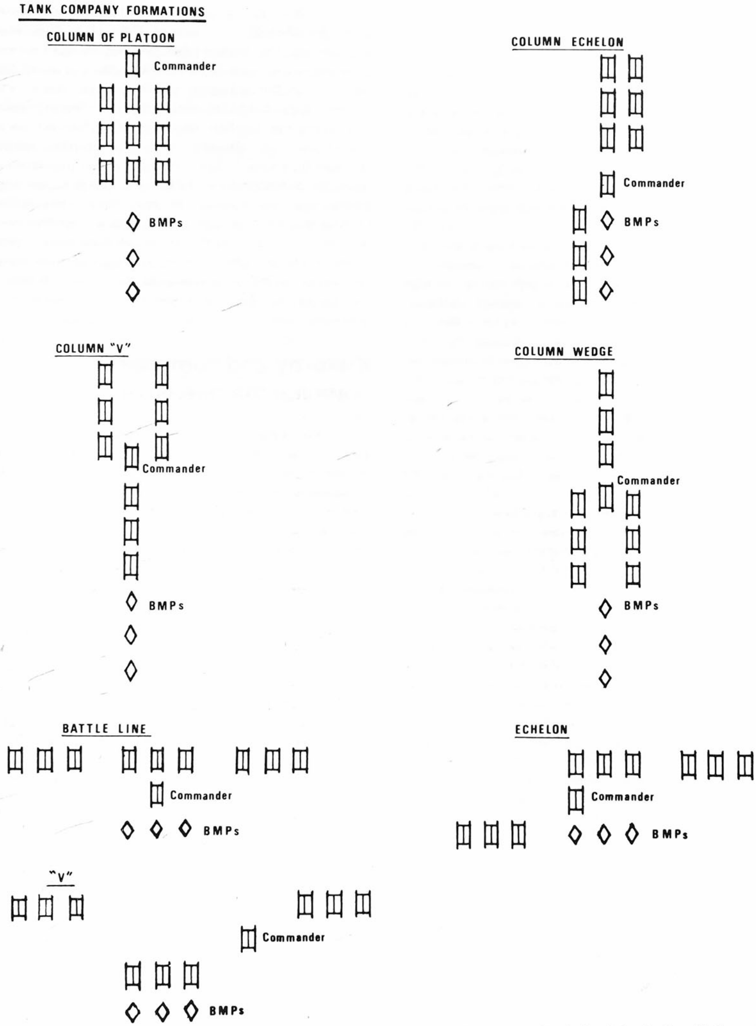
Computers are being used to make the combined-arms offensive more effective. Increasing automation is aimed at providing uninterrupted operational control with the shortest possible delay. Computers provide both information on situation, capabilities and requirements (in the same way as the tables, algorithms and nomograms previously used), and command (orders and messages), calculation and quantification based on this information. Computers can also aid decision making by displaying the relative merits of different decisions.

One of the key causes of inflexibility in the combined-arms assault is the fact that Soviet commanders tend to be concerned only with their own frontages. Unit boundaries and attachments are seen as inviolable. Speed of advance rather than co-operation with flanking units is relied upon for flank protection, and no Soviet commander should delay his advance to present a united front. The Soviets do however occasionally criticise a tendency to do precisely that in manoeuvres, especially in night combat. This lapsing into inactivity in the absence of thorough and detailed planning or top-down control has been seen repeatedly in Afghanistan. These tactics will undoubtedly lead to many exposed flanks and the possibility of counter-attacks against them. The top-down, centralised Soviet approach to command is intended to prevent lower levels of command from slipping into delay and inactivity if left to their own devices.

The Soviet emphasis on momentum in the advance makes their actions more predictable and thus easier to counter. While they stress creativity and the use of original manoeuvre, this will probably require a compromise with the rates of advance they demand. Just how great a compromise the Soviets will be willing to make is uncertain.

The Soviets stress "crushing the enemy rapidly" at all levels of conflict. Offensive action must not be "dragged out", and they are willing to pay a price for this. The Soviet norms for combat operations suggest an acceptance of an overall daily total loss of 20%, which would leave a division under one-third strength after five days. This is one reason why Soviet formations are configured for rapid rebuilding. "In nuclear war . . . superiority . . . will be attained by the *rapid* re-establishment of the combat capacity of the troops subjected to nuclear strikes", according to General A. Kh. Babadzhanyan. This applies also to those suffering losses from conventional weapons. Partially mobilised divisions could be sent forward to link up with the cadre of decimated ones.

In the words of Major-General V.A. Tsapko, boldness in



Notes: 1 BMPs are normally 250m behind the platoon in front. 2 In Battle Line the command tank often joins the line. (Not to scale. Frontage 0.6–1km, depth between platoons 0.25–0.6km).

combat comes from the "certainty that in the given situation one must act thus and only thus." The instilling of that certainty is the aim of Soviet training and military education. The commander must be able to "instantly evaluate the situation and to take the *only* correct decision in conditions of an acute deficit of time." The Soviets try to rectify their potential battlefield failings systematically rather than technologically. If a commander of a battalion, regiment or division has been properly educated, has absorbed the proper "culture" and truly understands military art, he will be able to select and apply the correct tactics, even if the communications links have been cut. The Soviets believe that this kind of behaviour, which they regard as true initiative, can be taught, and promote those who learn in order to ensure that it appears later at high command levels. Untutored inspiration coming from the unconscious is disparaged as not initiative at all but "native wit".

"Combat . . . calls not for mechanical learning by rote of possible variants, but rather for the creative analysis of the . . . situation." The Soviets have been progressively shifting the rote-learning threshold downwards through the rank structure, with the result that today's combined-arms battalion commanders are expected to do more than the division commander of a generation ago, when pre-planned offensives were expected to follow pre-planned nuclear strikes.

"Mirror imaging" is common to all armies, including the Soviet. On manoeuvres the enemy "blue" force fights and manoeuvres in the same way as standard Soviet units, rather than using the tactics of potential enemy forces. Thus Soviet forces in Asia train to fight armoured, highly mobile formations, while their potential enemy relies on infantry, fortifications and guerrilla warfare. This is just one of many problems in Soviet exercises, and one of the more frequent complaints in Soviet publications is that their exercises are run as rehearsed, artificial setpieces – another complaint seemingly endemic to armies world-wide.

Soviet writings tend to be self-critical regarding these limitations. The quality and the speed of staff work at regiment level and higher have been criticised, as has the tendency to place more reliance on prepared and rehearsed solutions to meet the complexities of modern warfare. The Soviet answer is better and more thorough training, including specialised training for junior staff officers who have not yet had the advantage of the lengthy and deep professional education of senior officers. But it remains possible that Soviet command, control and communication may defeat the combined-arms assault as much as modern weaponry. The tendency towards inflexibility, the reliance on detailed plans from above and the battle-drill formation, more suited to the Western Desert in 1940 than West Germany in the 1980s, may all undercut the combined-arms assault despite the Soviet attempts to correct and improve.

In the final analysis, it is probable that the combined-arms offensive will carry the day, although at the cost of heavy losses. This has been the US Army experience with units trained to fight in the Soviet style as part of the OPFOR (Opposing Forces) training system. Manoeuvre evidence shows that in the initial battles the "Soviet" forces (actually whole US battalions trained in Soviet tactics) usually take their objectives by combined-arms assault, although they do suffer heavy losses. In subsequent battles, when the defenders have studied the Soviet tactics and learned from their mistakes (and in wartime there may not be either the time or the survivors to do that), the defenders may be able to prevent the combined-arms assault from taking its objective, but in doing so they can suffer losses that would weaken them enough for the second echelon to take the position. The Soviet system will quite probably be a successful one.

Kulturny and computers: planning the offensive

The Soviet vision of a future battlefield in Europe is not based on a simple operational and tactical scheme depending on numbers, brute force and battle drill. The operational and theatre commanders and their staffs – steeped in the culture of Soviet and Russian military thought and all with a broad knowledge of what has worked in the past and what has not – are expected to fight a flexible, mobile battle characterised by manoeuvre, speed, shock and surprise.

The Soviets realise that the conditions of modern war will create Clausewitzian friction with a vengeance. Their whole system of command, operational and tactical, is designed to function not just under exercise conditions but in combat, when their opponents will be confronted with the same friction but may not be as well prepared for it.

The Soviets use a process of parallel planning at the various levels of command. For example, when a front-level operation is planned, one-third of the total planning time is expended at front level and two-thirds at army and division level. Pieces of the plan are issued as fragmentary orders by front to lower levels as they become available.

In the Second World War the Soviets found that effective (but time-consuming) preparation and planning often made the difference between victory and defeat. They realise however that in modern war the necessary time will not be available. Their answer is thorough professional military education of staffs and commanders so they will almost instinctively do the "right" thing. The parallel planning system, increasingly supported by the use of computers, is also intended to save time.

The Soviets will try to translate the increased speed and effectiveness of decision making permitted by computers

into a high combat tempo. Computing reduces the time between the forming of the commander's idea and the issuing of the operations order, allowing fleeting opportunities to be exploited. The computer is one part of the military technology that the Soviets will deploy in an effort to prevent conflict, conventional or nuclear, from becoming a long battle of attrition in which the fundamental strengths of its opponents may prevail.

At no time would the use of computers at tactical and operational headquarters take the commander or staff out of the observation-decision-implementation loop. Instead it would allow them time for creativity, by relieving them of formal, repetitive functions.

In the Second World War the Soviets showed themselves vulnerable to surprise, being unable to respond effectively to situations that changed too rapidly for thorough planning. Over the past 20 years their troop control and planning have been aimed at minimising the impact of surprise by allowing commanders to react, draft plans and communicate them to subordinate units more quickly.

By the late 1970s Ryad-2 computers had been deployed down to division level. Divisional artillery headquarters were also reported to have a similar system. Information is transmitted by means of data links between ACRV-2 vehicles. A wide range of improved box-body headquarters vans have appeared since the 1970s. They offer computers and communications systems mobility down to battalion level. Satellite communications systems allow the Supreme High Command access to front-line units.

Computers have been used extensively in Afghanistan, working effectively down to division level. Soviet exploitation of computers has grown in concept with the increased emphasis on conventional capability, which requires a planning process that is more rapid and more thorough.

The use of formulae and nomograms, worksheets and flowcharts has always been a central part of the Soviet staff process. Computers make the process quicker and more precise, and assure uniformity. The ideal has always been that any Soviet staff officer, in any given situation, will produce the same plan. Computers help to make this more likely.

The offensive in special conditions

The Soviets realise that any high-speed offensive in Europe must have an effective river-crossing capability. The Soviets have achieved this by building swimming or snorkelling capability into most of their AFVs, which possess a higher level of amphibious capability than those used by any other army. Sizeable amounts of high-quality engineer equipment for river crossings are held at regiment, division and higher levels and will be deployed well forward for river crossings.

The Soviets recognise three types of river crossing: opportunity, hasty and deliberate. Opportunity river crossings are likely to be unopposed, and will usually be carried out by an advance guard, reconnaissance patrol or forward detchament. These units will also attempt to take bridges by a surprise *coup de main*. The hasty crossing is similar to the Soviet hasty attack, while the deliberate crossing is similar to the breakthrough attack and may be a part of it.

On the march the leading APCs or BMPs will swim across and keep moving. The tanks will have to wait until their snorkels are fitted and a suitable snorkel crossing found or, more often, they will wait for the engineers to set up a bridge or ferry.

In an opposed hasty river crossing the tanks will overwatch and deliver direct fire from cover on the banks while the BMPs or APCs swim the river. Direct and indirect artillery fire will also support, as in the combined-arms assault. Once the BMPs or APCs emerge they will attack normally, except that they will probably lack tank support. If the bank is too steep or soft for the APCs or BMPs to climb out, the motorised riflemen will dismount at the water's edge and attack on foot. Once the far bank is secured the tanks will cross, preferably by ford, bridge or ferry. It normally takes 2–3h to get heavy equipment across and 8h for an entire division to cross and continue its advance. Rivers are obstacles, not objectives.

Deliberate river crossings, like the breakthrough attack, were often performed in the Second World War. They require great numerical superiority, intense artillery offensives and heavy engineer support. Airborne and heliborne troops will be inserted behind the enemy position for tactical missions in conjunction with such attacks.

The Soviet emphasis on continuous combat makes night operations important. Forty per cent of all field training is supposed to take place at night and Soviet weapons are well provided with night-fighting optics, including gunsights, searchlights, driving lights, and active and passive viewing equipment. While this has not yet reached the technical sophistication of US night vision devices, whose development was spurred by the Vietnam War, the Soviets have provided themselves with a wide range of effective equipment. In both 1967 and 1973 the Israelis found that Soviet equipment gave the Arabs the advantage in night combat.

Reconnaissance of terrain and approach routes and planning of attacks is more important at night. The combined-arms assault is much the same at night, except that battalions are usually in one echelon and the motorised rifle units lead the tanks. Artillery will provide illumination and mark objectives as well as performing its usual duties. Tactical formations are often modified to

make command control easier at night. Vehicles stay in column as long as possible, and dismounted squad skirmish lines adopt a wedge formation, the squad leader leading.

Night attacks are a matter of course, but will be launched two or three hours before first light whenever possible to allow daylight exploitation. Night attacks will also predominate when attacking prepared positions or through minefields or dense terrain, or when surprise is particularly valuable.

Despite the importance of night combat, Soviet capability may lag behind their theory. Soviet writings criticise a lack of "bold and decisive manoeuvre" and expertise during night operations. The Soviets may also need the night to replenish and rest their troops, rather than maintain a continuous offensive. In Afghanistan the Soviets yielded the night to the *Mujahideen* until 1984–86. Night positions were often unsecured and subject to attack or infiltration. Helicopters did not use their night engagement capability. It was only after four years of war that Soviet performance started catching up with pre-war tactical writings.

The Soviets will attempt to avoid combat in urban areas as much as possible. City fighting can slow down the offensive and cause heavy losses. However, the increased urbanisations of Europe and the need to secure routes for supply columns will make urban fighting inevitable. Whenever possible, the Soviets hope to seize urban areas by a surprise attack from the line of march. If this is not feasible the first echelon will bypass the area, leaving it for the second echelon. Only if bypassing is impossible will the first echelon attack. Again, they will try to take advantage of surprise, but if this is not possible they will subject the city to heavy air and artillery bombardment and then assault, heavily reinforced motorised rifle battalions being assigned small sectors and limited objectives in the slow, costly house-to-house fighting in which the Soviets excelled during the Second World War. In the 1970s the increased use of artillery weapons such as 122mm and 220mm multiple rocket launchers with incendiary submunitions and 240mm self-propelled mortars with concrete-piercing rounds gave the Soviets new urban combat capability. Direct-fire artillery will be used extensively.

The Soviets believe that any motorised rifle division should be able to operate in mountainous terrain, although they do hold specialised equipment for a number of formations whose wartime missions may take them into such country.

Soviet interest in mountain warfare certainly did not start with Afghanistan, though the current situation there, and in Iran and Pakistan, has prompted an improvement in capability. However, Afghanistan combat experience has also shown that actual performance falls short of tactical thinking.

The high-speed offensive is obviously less important in mountains, and attacks are normally made from direct contact. Communications will frequently have to rely on liaison helicopters and high-powered radios to surmount the mountains. The Soviets will aim to secure truck routes through the mountains and hold crucial peaks and crests. Dismounted operations will be emphasised. The significance of bridges and defiles will make the use of forward detachments more important, and the use of heliborne detachments will also increase.

Soviet anti-partisan operations, like their mountain operations, have increased in importance since the invasion of Afghanistan. The long experience of Russian and Soviet counter-insurgency campaigns has gone into the conduct of this campaign. In his first edition of *Soviet Military Strategy*, General Sokolovskiy stated: "The armed forces of the socialist countries must be ready for small-scale local wars." While there is little to suggest that this sort of preparation was in fact applied to the tactical units and their commanders until the war in Afghanistan was several years old, at the highest levels the Soviets may well have realised what was required for victory. They have been consistent in their choice of objectives throughout the war, even if they have underestimated the difficulties and overestimated their own tactical effectiveness.

The Soviets place great emphasis on "stability of the rear", and it appears in some statements of operational principles. Soviet Army formations were used alongside KGB and MVD units to fight partisans in the USSR and Eastern Europe until the early 1950s.

Chapter Five

The defence

"The Russian Army is a wall which, however far it may retreat, you will always find in front of you."

HENRI JOMINI, 1854

Offensively oriented, the Soviets perceive defence as a temporary measure, used only to gain time or consolidate an objective, or as an economy-of-force measure. All defensive operations and tactics are aimed at seizing the initiative and resuming the offensive as soon as possible. Soviet defensive thought is the result of a process of evolution starting in the 1920s, when the lessons of the First World War – especially the excellent German defensive tactics – were first adapted to Soviet conditions. But by 1941 the emphasis on the offensive was so strong that Soviet defensive concepts were unsound and the commanders, staffs and troops untrained in them, which contributed greatly to the defeats of the early war years. However, the Soviets started to improve their defensive operations and tactics, culminating in the great victory of Kursk in 1943. The well entrenched, camouflaged combined-arms defence in depth, with anti-tank weapons emphasised throughout and tank reserves deployed to counterattack, was victorious at Kursk and pointed the way to current practice.

Today the Soviet defence is less static than the Second World War's continuous belts of defence positions with most of their strength in the front line, and is based more upon lines of strongpoints and strong mobile reserves. Modern Soviet units defend with more than half their strength in the second echelon and in reserve. But the defence is still eclipsed by Soviet belief in the primacy of the armoured offensive, and defensive training for Soviet units occupies only one fifth of the training time devoted to offensive tasks. Whether this lack of training will undercut the theoretical strength of the defence remains to be seen.

There are some indications that the increased emphasis on deep battle and deep operations has led to a demand for the ability to defeat counterattacks in the depths of the enemy defence. One of the weaknesses of the Soviet defence against fast-developing counterattacks – the lack of time for thorough planning – may be reduced by the increased use of computers and improved communications. Attack helicopters are often seen as a reserve force against such counterattacks.

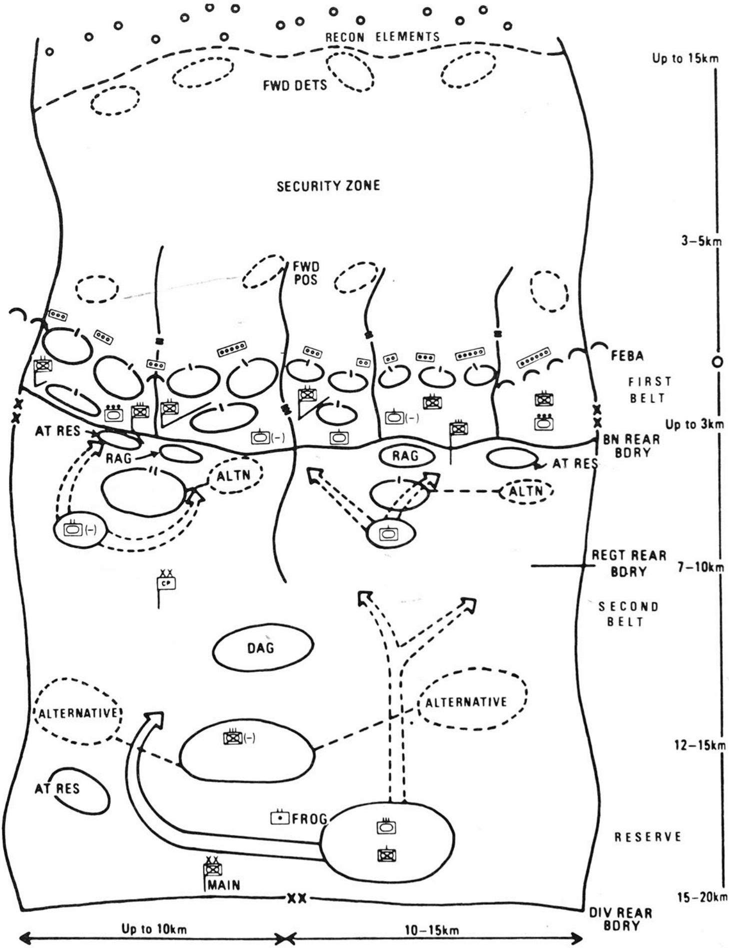
A defence can be either hasty or deliberate. The hasty defence occurs whenever a unit halts its advance to regroup, resupply, guard against counterattack, consolidate gains, secure a line of departure for second-echelon units, and to be in position to resume the advance at short notice. The Soviets view the hasty defence as the most prevalent type in modern conditions. The deliberate defence has the same goals as the hasty defence, but differs in the amount of time available for preparation.

Soviet defence is defence in depth, and the greater the time available to prepare, the greater the depth and the higher the level of command that will direct it. If time allows, front will designate the line to be defended, while army headquarters designates the defence positions and co-ordinates counterattack and artillery planning. Army also co-ordinates the preparation of divisional withdrawal plans, not so much for use in case of defeat, but if the Soviets intend to use NBC weapons on enemy troops at close range. Divisional HQs organise the strongpoints and defensive belts in their sectors, with regiments positioning sub-units. Of course, in mobile conditions, such as an advance guard unit forced to halt and await the arrival of the main body, the deployment of the hasty defence will be in the hands of the sub-unit commanders on the scene.

A complete deliberate defence will mirror an offensive formation. As in the offensive, divisional and regimental reconnaissance patrols are positioned up to 30–50km forward of the frontal lines. They report the advance of enemy forces, but do not engage. The security zone behind the reconnaissance screen, is up to 16km deep at divisional level, up to 30km at army level. The units in the security zone are usually from the second echelon of the defending force, similar to forward detachments in the offensive. Their mission is to channel the enemy advance, call in artillery fire, and force the enemy to deploy and attack their positions, slowing the advance. These units hold a frontage four times its normal defensive length, and make much use of ambush tactics. Tank units are positioned in the security zone to support them, prevent them from being encircled, and help them disengage when they are ordered to withdraw.

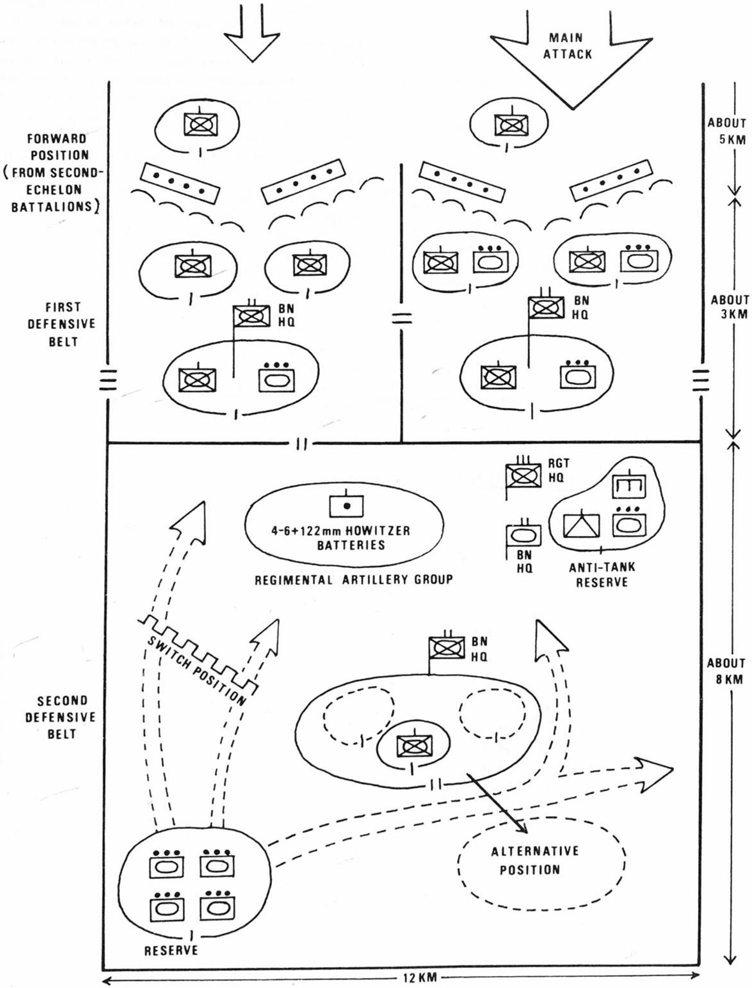
Behind the security zone, and in place of it in most hasty defences, are the forward positions. Made up of companies and platoons from first-echelon defending units, they are

MOTORISED RIFLE DIVISION ON THE DEFENSIVE



Notes: 1 Right-hand sector is a subsidiary sector. 2 RAG = regimental artillery group, DAG = divisional artillery group. 3 Planned deployment areas for the anti-tank reserve are not shown. 4 Second-belt strongpoints, when fully deployed, are similar to those in the first belt. 5 Platoon outposts are not shown. 6 Divisional helicopter squadron, when provided, will help cover security zone.

MOTORISED RIFLE REGIMENT ON THE DEFENSIVE



Note: Up to four alternative positions may be prepared for the anti-tank reserve. Battalion second echelons would not normally counterattack except in rough terrain, counterattacks being delivered by the regiment second echelon.

roughly analogous to advance guards in the offensive, but are considerably weaker. Positioned 3–5km forward of the first defence belt, forward positions guard against surprise attack, engage enemy patrols and probes, and disguise the location of the defence line so that attacks and artillery fire aimed at the main defence line will be directed against the forward positions instead.

The observation posts, patrols and battle outposts of the first defence belt are 1–2km forward of the front lines. Sometimes, especially when forward positions are not established, each first-echelon battalion will establish a platoon-sized battle outpost 1–2km to its front, in addition to the standard observation and listening posts.

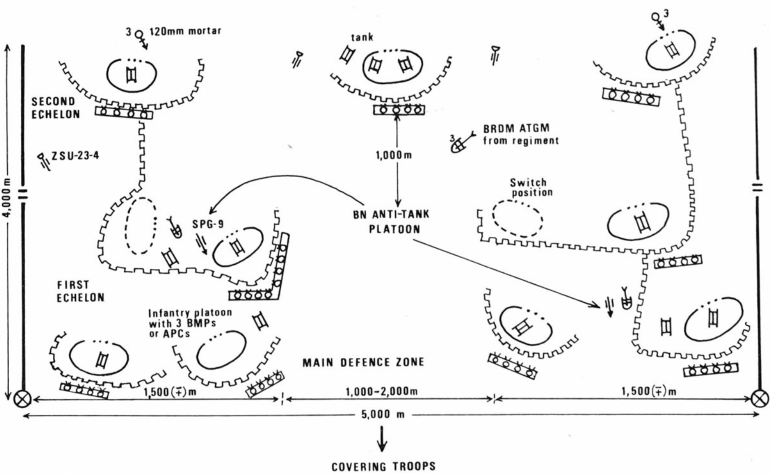
Each unit's first echelon is its first defence belt; its main line of resistance. A division's first defence belt can be 15km deep, positioned to take advantage of terrain and cover – especially water obstacles and heights – while maintaining concealment, dispersion and depth for its weapons. The purpose of the first defence belt is to engage and defeat the enemy attack.

The division of forces between the first echelon, second echelon, anti-tank reserve and reserve of each unit are the same as on the offensive, from front down to platoon. The second echelon forms the second defensive belt, 8–10km back from the first belt in an army-level defence, five kilometres in a division and three kilometres in a regiment. It contains any enemy units that break through, infiltrate past or outflank the first echelon and serves as a backstop, along with the anti-tank reserve, if NBC weapons breach the first-echelon positions. Spoiling attacks against enemy assembly areas may be launched by tank forces from the second echelon or the rear of the first echelon, which pass through the defences.

Unit anti-tank reserves are deployed in direct support behind the first defence belt as part of the overlapping fields of fire of the defence. Their long-range anti-tank weapons can supplement the fire of the first defensive echelon. They also act as a mobile force to block any threatened penetration, and each sub-unit of the anti-tank reserve may be assigned up to four alternative positions. In addition to ATGMs, anti-tank guns and sometimes tank units, anti-tank reserves often include mobile obstacle detachments of engineers using their specialised vehicles to lay minefields to channel the advance of any enemy penetration, block advance routes and prepare hasty emplacements for the anti-tank reserve. At army level the attack helicopter regiment and the air assault battalion can be used as part of the anti-tank reserve.

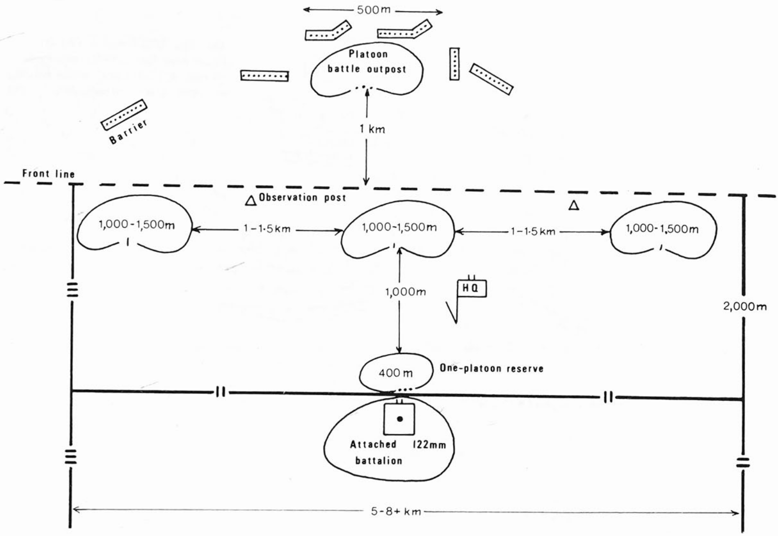
The two forward defending echelons and the anti-tank

MOTORISED RIFLE BATTALION: DELIBERATE DEFENCE IN TWO ECHELONS



Notes: 1 Pre-arranged final protective artillery fire is ranged in on points in front of the main line of resistance and throughout the depths of the defence. 2 Each rifle platoon has 3 BMPs or APCs. 3 Heavy weapons (AGS-17s and HMGs) deployed in company strongpoints.

BATTALION DEFENDING IN LINE (ONE ECHELON)

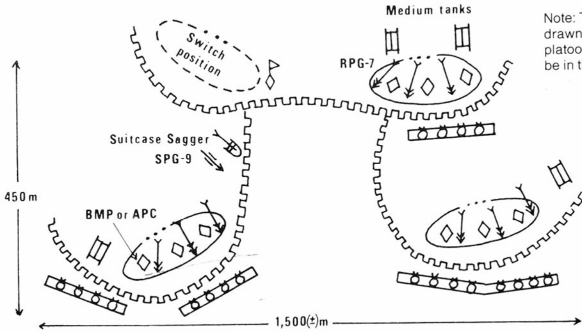


reserve create overlapping fields of fire both in front of the position and through the depths of the defence. Obstacles and minefields will be used to channel the enemy into "fire pockets", or concentrations of fields of fire along the most probable axes of advance. The complementary system of Soviet weaponry, especially armour-killing systems, makes this possible at all ranges. The weapons are positioned so that if the attacker turns to engage one strongpoint he exposes his flank to another as at Kursk. The weapons will also be concentrated on a number of predesignated points, with the ability to shift from one to another on a prearranged signal. This "manoeuvring fire" provides massed firepower that can be rapidly re-directed. Ambushes are also used in conjunction with the main defence, especially when the Soviet force is covering a wide front, as in the security zone, when covering a withdrawal, or when the terrain and tactical situation favour them. Ambush forces in well camouflaged positions are often located forward of the Soviet front lines. These forces can include attack helicopters.

Behind the defensive belts of the first and second echelons is that of the reserve, the third defensive belt. This is the unit's counterattack force, deploying and attacking with the support of the first and second belts and the anti-tank reserve to repulse the enemy, seize the initiative and resume the offensive. If the reserve (small, like all Soviet tactical and operational reserves) fails to do this, then the unit behind it will have to, as in the offensive. The task of halting the enemy and counterattacking may fall to the defending division's second-echelon regiment or to the defending front's second-echelon army. The Soviet telescoping system of overlapping echelons and forces works in the defence as well as the attack. Each commander has his counterattack force, in the form of the reserve, to deal with the enemy in his sector, and not only is there a second echelon behind him, but the higher commander has his own reserve, which can be committed to the critical area of his sector. The combination of interlocking defences and counterattack forces not only gives the Soviet defence great depth, but also gives it flexibility. The Israelis found the Egyptian version of this defence difficult to overcome in the first days of the 1967 war. With better leadership and greater tactical competence it might have held the Israelis to a long "break-in" battle, had the Israelis not had air superiority and worked out the counter to these tactics in advance.

The Soviets see timely and effective counterattacks as the key to defensive tactics. The counterattack will be

MOTORISED RIFLE COMPANY IN DELIBERATE DEFENCE ("V" FORMATION)



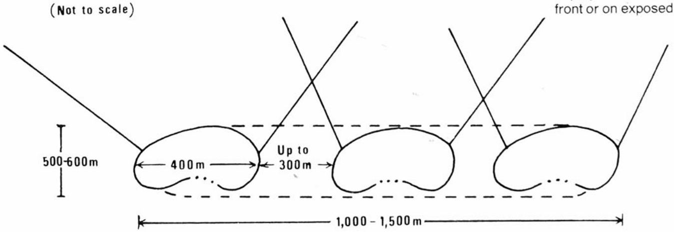
Note: The SPG-9 and ATGM are drawn from the battalion anti-tank platoon. AGS-17s and HMGs would be in the "apex" strongpoint.

COMPANY DEFENSIVE STRONGPOINTS

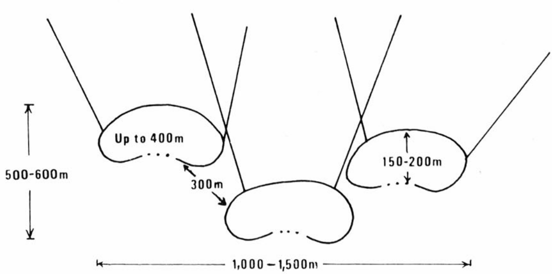
Note: One to three tanks (if a tank company) or motorised rifle squads (if a motorised rifle company) may be deployed as outposts 200m to the front or on exposed flanks.

Line formation

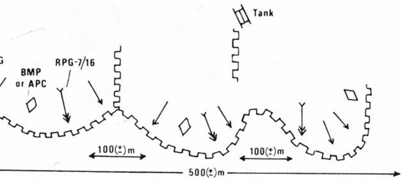
(Not to scale)



"V" formation



ORISED RIFLE PLATOON IN DELIBERATE DEFENCE (LINE FORMATION)



aided by the fire of the strongpoints in the first and second defensive belts. These units will hold their ground to the last round unless ordered to do otherwise. They may only counterattack themselves or move on specific orders from the next highest level of command.

When the defence is to be in even greater depth than usual, the third defensive belt can be turned into the equal of the first two belts. In other situations regiments and divisions will dispense with the third defensive belt, positioning the reserve in the rear of the second.

The Soviets maintain their tripartite division of command posts for all battalions and larger units while on the defensive. The forward CP is often in the first defence belt, or in the forward part of the second defence belt. The main CP is in the rear of the second defence belt, and the rear CP is with the service support elements, behind the reserve. Division and higher-level formations will establish alternate CPs.

Soviet sub-unit defensive tactics are based on a series of strongpoints. Each battalion, company and platoon defends in a strongpoint made up of three strongpoints of its component units. These strongpoints are deployed in any of the normal sub-unit formations – line, "V", wedge, or with one or two echeloned to the flank – modified to take advantage of terrain and cover. Battalions often defend in a single echelon, keeping at least one company 500m back in place of the second echelon, and the reserve platoon to the rear of that position. As in the attack, companies and platoons always form single echelons. The rearmost or second-echelon companies of a battalion or battalions of a regiment may have their attached sub-units – especially tanks – removed and re-attached to the forward units. All Soviet strongpoints are deployed for all-round defence, which allows the defending forces to guard against being outflanked and to concentrate their fire on any forces behind them. Strongpoints will be sited in mutually supporting crest and reverse-slope positions whenever possible, but the limited depression of tank and BMP guns will preclude the use of many good positions.

If a battalion is assigned a mission in the security zone, companies and platoons will occupy their usual strongpoints but the gap between companies will be doubled.

In a defensive position each motorised rifle squad digs connecting crawlways for itself and a pit for its APC or BMP, all well camouflaged. If time permits, engineer equipment and tanks with dozer blades will aid in constructing tank pits and fighting positions. Squad and platoon positions are linked to each other by communications trenches. If a squad is positioned in front of a platoon or company strongpoint as a battle outpost, a crawlway may be dug for communication. Alternative positions are also prepared, first priority going to anti-tank weapons. The Soviets will dig as deep as time permits. Camouflage is emphasised, not only against visual detection, but also against electronic reconnaissance, using dummy radar reflectors, expendable emitters and chaff from aircraft and artillery. However, camouflage training is often lacking and camouflage discipline is often faulty in combat units.

BMP and APC-equipped motorised rifle units and their attached tanks defend in much the same way, despite the BMP's greater combat power. Some Soviet officers have however suggested that BMP-equipped squads should have their frontages increased from 50–60m to 100–150m, 200m deep, to allow the BMP to give supporting fire from the flank and rear. This has met with disagreement because of the command control problem. However, BMPs in a platoon strongpoint are often positioned 100–150m behind the squads to give depth to the defence.

Unlike tank-unit practice, there is no "wandering" BMP or APC to engage probes, which will be fired at by one vehicle per platoon. Infantry weapons will usually hold fire until the enemy is 400m away.

Soviet defensive organisation is impressive. The enemy is located by the reconnaissance patrols and forced to slow his advance in the security zone, while long-range artillery fire starts to disorganise his attacking units. The forward positions will delay, weaken and hopefully mislead the enemy. When he prepares to attack the main defensive echelon, the enemy's assembly areas will be hit by artillery, air strikes and NBC weapons. A spoiling attack may be launched to disrupt preparations, and an enemy preparatory bombardment will be met by Soviet counter-preparation, including extensive counter-battery shoots. The enemy attack itself will encounter mines, obstacles, ambushes and battle outposts between the line of departure and the Soviet front lines. Meanwhile, the Soviet artillery will lay down pre-arranged final protection fires in front of Soviet positions. The weapons in the first defensive echelon and the anti-tank reserve will then open fire, ATGMs at 3,000m, tanks and AT guns at 1,500m. The powerful overlapping fields of fire are intended to be capable of halting an attack even if the enemy preparation, which may include NBC weapons, has inflicted heavy losses on the defenders. If the enemy succeeds in getting

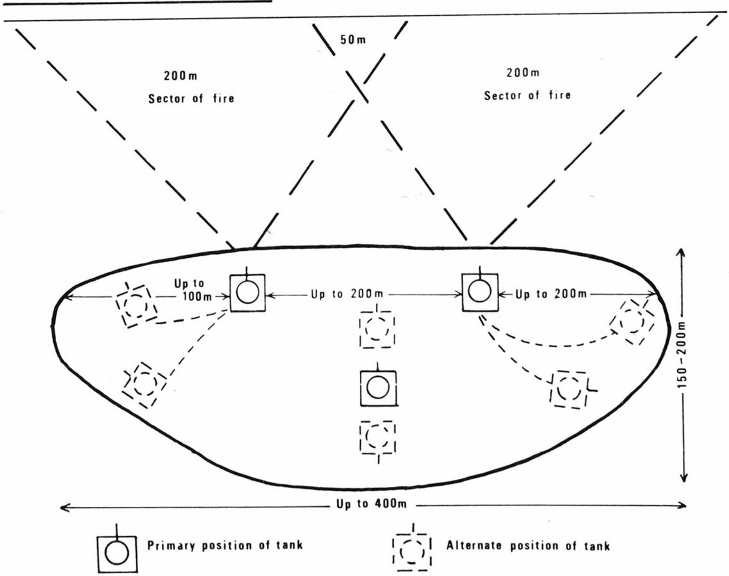
past the first echelon despite the minefields, fire pockets, manoeuvring fire and overlapping fields of fire, the surviving strongpoints will hold their ground when the enemy advances towards the anti-tank reserve and the second defensive echelon. If the enemy penetrates deep enough the artillery will fight with direct fire, otherwise it will continue to put down pre-arranged fires throughout the depths of the defence. When, in the defending commander's view, the time is correct for a counterattack, the reserve will strike out from its position, usually in the third defensive echelon, and force the enemy to retreat in a meeting engagement. Although the reserve is small, it will be supported by artillery fire, which will probably have to be direct or pre-arranged, and by fire or counterattacks from the strongpoints in the first and second defensive belts. If the counterattack by the reserve is not sufficient, then the next echelon behind the defending unit will attack instead.

Retrograde operations include the delaying action, the withdrawal, and the retirement. While the Soviets consider them a part of defensive operations and tactics, they seldom discuss them except as required to reduce vulnerability to NBC weapons. They are also used prior to regrouping as well as when leaving a hazardous situation.

A unit's first echelon will normally fight a delaying action when a withdrawal is ordered, using ambushes, minefields, demolitions and long-range artillery fire. If threatened with being engaged in a decisive combat, the rearguard will disengage, aided by the second echelon and reserve units kept back for that purpose. The withdrawal is planned and co-ordinated at the highest possible level, and it is covered by strong rearguards, demolitions and strong flank security detachments on parallel routes, which also occupy key terrain features until the rearguard passes through. The retirement, following a successful disengagement and withdrawal, is a road march away from the enemy, but with a third of the force acting as rearguard. A force will retire to an assembly area before re-engaging the enemy.

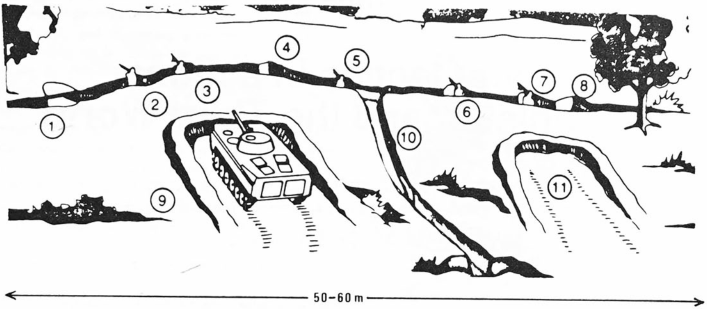
The Soviets' defensive concepts share many similarities with their offensive concepts, and thus many of the same weaknesses. The insistence on defending in place – units leave their strongpoints to withdraw or counterattack only

TANK PLATOON DEFENSIVE STRONGPOINT



The diagram shows a tank position defending in "V" formation. Line, wedge and echelon formations can also be used to take advantage of terrain and to suit tactical requirements.

SQUAD DEFENSIVE PREPARED POSITION



1 Covered firing position. **2** Rifleman position. **3** Machine-gun firing position. **4** Alternative machine-gun position. **5** Rifleman position. **6** RPG position. **7** Machine-gun firing position. **8** Alternative machine-gun firing position. **9** Firing position for squad BMP. **10** Connecting trench. **11** Alternative firing position for squad BMP. BMP-2 squad positions and armament differ.

on order from higher command – undercuts the ability to fight a mobile battle, although in the Soviet view mobility in the defence is obtained through depth. The Soviets must be prepared to accept that these units may often be outflanked or surrounded, and they believe that by holding their ground these units will weaken the enemy enough for the counterattacks to succeed. But the approval for a counterattack, required at all levels, may not be possible to obtain in battle, especially if there is communications jamming or the units are cut off.

The Soviet defence, like the offensive, seeks to strike at enemy forces in depth, not simply those in contact. Headquarters, nuclear-capable units and reserve formations are priority targets for artillery or air strikes as well as counterattacks or spoiling attacks.

In Afghanistan the Soviets use the government (DRA) armed forces and militia to hold the more outlying areas (on an operational level) or outposts (on a tactical level), thereby creating the necessary depth to the defence. They defend most of the positions that are subject to Resistance attack. This helps divert their efforts away from Soviet-defended positions and sometimes, as at Khost in 1985, allows air power to be called in against the now concentrated Resistance. The Soviets themselves defend the key air bases, command centres, garrisons and chokepoints. The Salang Pass highway – the direct route to Kabul – has well defended Soviet outposts along its length.

The defence of Kabul has been the major defensive task, especially since the Resistance rocket attacks of January 1985. The Soviets have expanded the perimeter outside the city to up to 10–15km, using primarily DRA forces in outposts supported by patrols and local mobile reserves. The perimeters around Soviet air bases were frequently limited in size in the first four years of the war, and patrolling was often unaggressive. But the increased availability of 107mm and 122mm rockets to the Resistance has apparently forced a change in these tactics, and the Soviets have tried to clear large areas around high-value installations.

The size and composition of the defending force, the time available for preparation and the terrain all determine the nature of the defence. The larger the unit, the greater the flexibility to conduct active, mobile battles. Battalions, with their limited reserves, have little flexibility; companies, without reserves and with less experienced commanders, have virtually none. The Soviets will certainly use built-up areas as part of their defensive positions – they could hardly avoid doing so considering the degree of urbanisation in Western Europe. But although they are capable of turning villages and cities into new Stalingrads, the Soviets will not make them the cornerstone of their defence.

As when attacking, units assigned key sectors hold less frontage than those in secondary sectors. The Soviet concept of defence in depth is achieved by deep echeloning and counterattacks. The depth of the Soviet defence not only gives them mobility, it makes them difficult to outflank or envelop except by the longest and most powerful operations, even if an adjacent unit has been defeated. The Soviets remember the wide German encirclements all too well. Their defences are intended to prevent a recurrence.

As with Soviet offensive tactics, many of these strengths can also become weaknesses. Units smaller than regiments lack the depth and flexibility required in modern warfare. If the series of counterattacks fails to regain the initiative, the first-echelon Soviet forces may well find themselves "in the bag".

Chapter Six

Soviet tactics in action: Afghanistan and the Third World

"We should remember Lenin's words, that in our society everything that advances the cause of Communism is moral."

LEONID BREZHNEV, February 24, 1976

Afghanistan

Soviet strategic aims have remained relatively constant throughout the war in Afghanistan. Foremost is the maintenance of an acceptable government in Kabul; there can be no question of power falling into the hands of Islamic guerrillas. Despite the different approaches to ending the war seen under Gorbachev, it is hard to see how any such government could ever prove equally palatable to the Afghan Resistance and so lead to the return of the refugee populations from Pakistan and Iran.

The Soviet Union's Afghan strategy must be seen in its regional context. Victory or failure in Afghanistan will in large part be defined by how Soviet interests are served by developments in the two regions bordering the country: Iran and the Gulf, Pakistan and the Indian sub-continent. In their first large-scale war since 1945, the Soviet forces appear to have suffered their share of frustration. But while the Soviet Army seems to have had a great deal of trouble adapting to counter-insurgency warfare, it is quite likely that Moscow sees itself as winning the war.

While the relative importance of the country in overall Soviet strategy is uncertain, there are unquestionable geopolitical advantages to be had from a friendly Afghanistan, even one whose government must be supported by military force. This remains true whether Soviet strategy is seen as being aggressive, defensive or opportunistic. In any case, Afghanistan provides a base – or a shield – for use when exerting future political leverage and military pressure against Pakistan, Iran and the Gulf.

Another goal may be to show other countries that they cannot count on effective Western aid if they incur the wrath of the Soviet Union.

The withdrawals of troops with limited counter-insurgency value that took place in 1980 and 1986 must be seen not as an end of policy but rather as a tool. Similarly, the indirect talks between the DRA and Pakistan should be regarded as a way of achieving Soviet goals rather than compromising them. By late 1987 it was looking as though the Soviets would like to leave Afghanistan, but wanted to win first. The means used to this end are probably shaped by a long-term vision of an Afghanistan modelled on Mongolia – retaining nominal independence but fully integrated economically and militarily with the USSR.

Moscow's commitment to propping up an acceptable regime in Kabul, to increased geopolitical influence in the adjoining regions, and to the continued alteration of the world correlation of forces all point towards a protracted war. If the Soviets maintain their goals and continue to improve their tactics, attrition may eventually prevail, although complete peace in Afghanistan is unlikely.

Counter-insurgency warfare

The Soviets have a long history of counter-insurgency warfare covering the Tsarist wars in the Caucasus and Central Asia, the Civil War, the long war against the resistance in Central Asia and the North Caucasus in the 1920s–30s, suppression of post-war anti-Communist guerrillas in the Ukraine and the Baltic States, and the Polish Civil War of 1944–49. Each of these conflicts had its influence on the Soviet Army's methods, and many of the lessons from them have been acted upon in Afghanistan.

In Afghanistan the tactics have appeared to exceed even the normal level of inefficiency associated with the Soviet military. As is so often the case, large amounts of historical experience do not yield tactical effectiveness. For example, the Soviets proved inexpert in mountain warfare at the start of the war, despite having a wealth of past combat experience to draw upon. The lessons of old counter-insurgency campaigns had to be relearned, while the differences between history and the current Afghan situation also had to be understood.

Since 1982 at least, the Soviets have seen the war as essentially a political event, the role of military action

being to make political consolidation possible. They envisage something akin to imperialist-style absorption, which makes a rapid victory less important. Gaining the affection of the populace is unnecessary: the Soviet position is secure in Poland, even though they are certainly not loved. Nor do they aim to provide peace and security throughout the entire country; rather they will secure what is valuable and disregard the hinterlands.

In an effort to consolidate this control the Soviets have sought to create or, preferably, co-opt indigenous leaders and institutions. This process has included the use of the National Fatherland Front incorporating non-party figures, as in much of eastern Europe. Since the 1979 invasion the Soviets have turned away from the brutal and hamfisted attempts at radical social reform that characterised DRA rule in 1978–79. Instead, Islam has been used as much as possible to legitimise DRA rule, much as the "Red Mullahs" were used in Central Asia in the 1920s–30s.

The building up of the institutions of a Moscow-approved government will be accompanied by the development of proxy armed forces. In Central Asia and Poland, local Communist forces carried much of the burden of the conflict. In Afghanistan the Soviets have made repeated attempts not only to field effective DRA forces, but also to buy the services of local Afghans for intelligence and combat. But although the exploitation of internal divisions has been seen throughout Russian and Soviet counter-insurgency campaigns, it has had limited effect in Afghanistan.

M-30 M-1938 122mm howitzer captured in Afghanistan and used by the Resistance. The guerrillas have captured a number of D-30s and M-30s and have used them in action. Although their size and a shortage of ammunition have limited their effectiveness, these guns have done significant damage, including the destruction of several ammunition-carrying transport aircraft at Khost in 1984. *(Committee for a Free Afghanistan)*

Command and control

The Soviet command structure in Afghanistan has shaped tactical evolution. The standard hierarchy – strategy-operations-tactics – does not frequently hold up in counter-insurgency conflicts, with relatively low-level activities sometimes being of interest at the highest levels of government. Throughout the war Soviet activities have

December 1979: the Soviet invasion force of paratroopers and BMDs moves out and sets up checkpoints to control access to and egress from Kabul. *(US Information Agency)*

been characterised by strong top-down command, a not uncommon state of affairs in other limited wars. The initial invasion was run by Southern GTVD under the direct command of then Assistant Minister of Defence Sokolov. Since then, major offensives have been marked by the dispatch from Moscow of *Stavka* representatives who set up forward ground and air command posts with their own communications links to the capital.

While Turkestan Military District handled the mobilisation before the 1979 invasion, it is likely that for much of the war its function has been largely that of logistics and service support. The Southern TVD High Command (GTVD), since 1985 under highly regarded former Commander Group of Soviet Forces Germany, General Mikhail Zaitsev, is reported to have overall authority.

The in-country command, known as the Limited Contingent of Soviet Forces in Afghanistan (LCSFA), has not achieved Group of Forces or Military District status, lacking institutions such as an identified military council and its own military educational facilities. The relationship between headquarters LCSFA and the 40th Army is uncertain. The headquarters for 40th Army may be incorporated into that of LCSFA, to be reactivated if LCSFA is required to project forces outside of Afghanistan. Alternatively, headquarters 40th Army may be subordinate to LCSFA, acting as its operational command agent.

The combat divisions and separate brigades in Afghanistan probably report to LCSFA, either directly or through 40th Army. Higher headquarters of the motorised rifle divisions headquartered in the Soviet Union but not involved in the war have not been firmly identified.

The operational division of responsibility does not necessarily follow this form, since the command structure must integrate both Soviet and DRA forces. By 1982 the Soviets had divided Afghanistan into two operational commands (*operatsiunaye gruppa*), with HQs at Kabul and Termez, and seven to nine territorial tactical commands. Such integration is possible because of the widespread Soviet control of the DRA armed forces. While the full DRA command structure remains in place, the actual authority is in the hands of the Soviet advisers at all levels.

The installation of advisers throughout the DRA military command structure is only one aspect of a campaign to consolidate Soviet control in Afghanistan. As well as state-to-state and party-to-party ties, there are links between the respective secret police forces and a high degree of economic integration.

The DRA military maintains its own chain of command, running from the Ministry of Defence in Kabul to the three geographical corps headquarters and a number of independent divisions and brigades. Under the corps are divisional headquarters. The corps and divisions tend to control all army units in an area. When more than local operations are required, different regiments and divisions each contribute a column to a larger force. In 1986 a nominally DRA operational-level command for multi-division operations was in action.

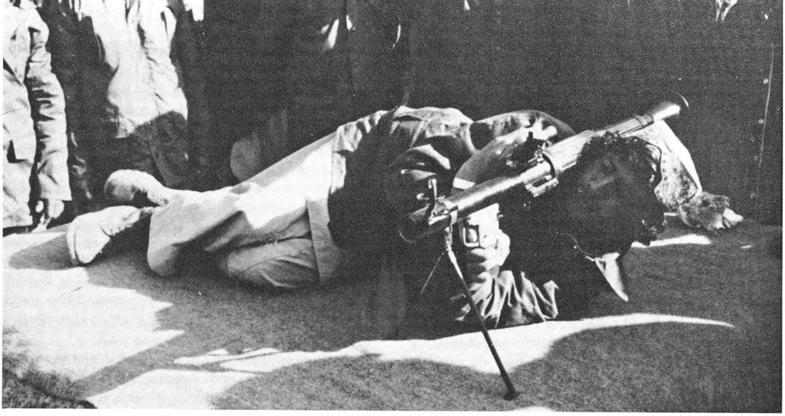
Throughout the war, rapid operational or tactical response has been limited by the command system. This was especially true in 1980–83, when the war ran at a very deliberate pace. All but urgent calls for air strikes had to go through Kabul, leading to at least a one-day wait. Ground units responded even more slowly, and all movements were well advertised in advance.

Since 1984 there have been indications that the regional command can order tactical ground force actions, particularly with special operations forces.

Operational approach

The initial operational goal of the invasion was to seize the government and infrastructure of Afghanistan. Since then the Soviets have sought long-term political and military solutions. They want a relatively low troop commitment, a reduced casualty rate (apparently more important than the total figure), and fighting kept to a relatively low intensity. All this differs from "conventional" Soviet operations, which stress quick and complete victory, using maximum force in minimum time. These principles apply only to wars in which the Soviet Union itself is at risk, however. In Afghanistan, as Marshal of the Soviet Union Kulikov, Commander-in-Chief of the Warsaw Pact, explained to a Yugoslavian journalist in April 1987: "There is no war in a conventional sense. It is difficult to apply experience there in a war as might be applied to Europe. War in Afghanistan is very strange."

By 1987, Soviet operations covered a broad spectrum of activities. First, they were continuing to try to increase the legitimacy and effectiveness of the DRA government and its institutions, especially the WAD (formerly KHAD, the DRA secret police). They sought to interdict the increased flow of supplies to the interior, making continued use of large-scale combined-arms mechanised forces but also increasingly relying on light, special operations forces, frequently heliborne. They hoped to achieve significant depopulation of selected areas through destruction of the agricultural infrastructure. The means to this end included massive use of firepower, supplemented by combined-arms offensives which also disrupt areas that could be used for Resistance operations (perhaps the most important purpose from the Soviet viewpoint) and prevent the most significant Resistance leaders from consolidating their positions. They targeted any guerrilla leader showing signs of becoming an effective national or regional figure. They had created an intelligence network of aircraft, patrols, sensors, agents and informers to produce the information needed for accurate use of their superior firepower. Finally, they continued to defend key objectives.



In a training camp a Resistance instructor shows how to keep the body and feet out of the backblast area when firing a Chinese-made RPG-7 prone. *(David C. Isby)*

The Soviets are not trying to occupy the countryside of Afghanistan, 80–90% of which remains outside their control. They do however want the cities, the airfields and the roads. These tactics have remained more or less constant since 1980, with the Soviets defending only what they value. Until 1984 almost all of their offensive operations were in response to threats to what they considered to be vital objectives.

Since then they have tried to ensure that such threats never even materialise. To do this they have depopulated large areas of the countryside, near the roads, in food-producing areas or along infiltration routes. Mao Tse-Tung wrote: "The guerrilla must move amongst the people as a fish swims in the sea." Instead of trying to catch the fish one at a time, the Soviets are draining the ocean. In his 1864 campaign in Virginia's Shenandoah Valley, US General Phillip Sheridan gave orders for destruction so thorough that "a crow flying over this valley will have to carry his own rations." The Soviets aspire to a similar level of devastation.

Before 1984, a visitor to much of Afghanistan would not even have been aware that there was a war going on. Today the conflict is much more intensive, although in some remote mountainous areas such as the Hazara Jat and Nuristan there has been no attempt to reimpose communist control since DRA forces were driven out in 1979. Rather, the Soviets try to buy off and divide Afghan groups in these places. In the winter of 1985–86 they greatly expanded the application of these tactics, aiming at tribes in both Afghanistan and Pakistan such as the Afridi, Shinwari, Wazirs and Hill Mohmands.

Economy of force is at the heart of Soviet tactics in the war. One of the many reasons why Afghanistan is not "the Soviets' Vietnam" is the relative size of the forces involved as a percentage of their parent armies. Whereas the US Army was at one point down to less than a full deployable division at home, the Soviets have committed only a small proportion of their divisions to Afghanistan. While the war may not be as cheap as it was in 1981–82 – when the Defence Intelligence Agency put its cost at 1–2% of Soviet defence spending – it remains affordable.

The Soviets have emphasised political tactics at the expense of military. Political tactics have also dominated efforts to maintain pressure on Pakistan, with the aim of reducing Pakistani support and helping to realise Soviet regional ambitions.

The DRA armed forces are, for all practical purposes, an adjunct of those of the Soviet Union. The Soviets have tried to create and use DRA armed forces as a cost-effective, if inefficient and often unreliable, counter-guerilla force. The extensive use of militias in addition to uniformed forces is another aspect of the policy of building on existing Afghan loyalties and divisions, although militia reliability has so far been rather low. The DRA Army, *Sarandoy* , Border Troops, police and some militias have throughout the war carried most of the burden of the fighting around the borders, and have been responsible for most of the static defence. Militias are used in an effort to exert influence in the hinterland, DRA forces to defend most objectives, and the Soviet Army only to protect what is valued most. In 1986 the Soviets tried to recreate an independent DRA capability for offensive action.

DRA irregular forces include the militia and WAD, the intelligence service that operates through networks of agents and informers. The militia, by and large, are unreliable and of limited combat value. In 1987, however,

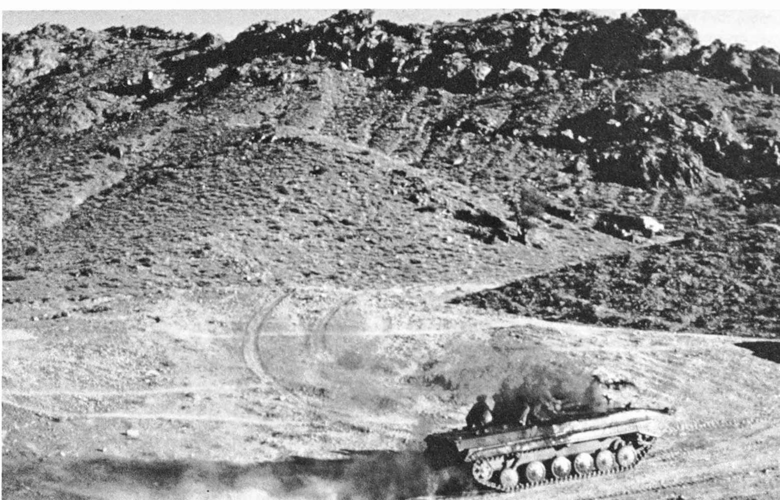
militia forces were creating severe problems for the Resistance around Khost, in Paktia, in the Kunar Valley and around Kandahar. To back up these actions the Soviets have, since 1986, made increased use of *agitprop* detachments, which visit Afghan villages in an effort to win "hearts and minds" to the Communist cause.

Soviet special operations forces were widely and effectively used in the 1979 invasion. Since then they have carried out ambush patrols along Afghan infiltration routes and extended dismounted operations into Afghan-controlled areas. They are trained and equipped to operate either independently or in conjunction with "standard" combined-arms mechanised forces. Whether heliborne or dismounted, the special forces formations are smaller than combined-arms forces and can achieve surprise, something which is effectively impossible for roadbound mechanised units. Because they are smaller, they require more precise targeting and hence better intelligence. The use of such forces greatly increased in 1984–86.

In contrast, the apparent recent improvement in combined-arms tactics must be viewed in the light of a very low original level of competence. Until 1984 the Soviets were unable to take advantage of guerrilla inexperience, and seldom moved on the high ground or practised aggressive small-unit tactics. Even now the bulk of their forces – motorised rifle units mounted in BTRs or BMPs – remain roadbound, with limited tactical flexibility. Nonetheless, such forces continue to be widely used for large-scale ground sweeps, convoy escort and defence of key installations.

Since 1984 Soviet combat forces in Afghanistan have been essentially divided into two armies in a manner echoing the experience of other armies fighting guerrilla wars: smaller forces capable of offensive counter-insurgency operations, and larger but militarily less significant forces, comprising the bulk of the motorised rifle divisions and at least part of the airborne division. The latter are used mainly for garrison duty, defence, convoy escort and large combined-arms offensives. They could also be projected into conventional conflicts elsewhere in South Asia.

Individual soldier skills and small-unit tactics have been a consistent weakness, and competence and initiative have often proved wanting. According to the Afghans, however, the Soviets are gradually becoming more adept, particularly since early 1984. During the invasion and early in 1980 most of the men in the motorised rifle divisions were recalled reservists from the Turkestan and Central Asia military districts. Often with little refresher training since leaving their conscript service and never mobilised before as part of these divisions, most of them were Moslems and had little enthusiasm for killing their brethren, though only a few actually changed sides and joined the Resistance. By mid-1980 the reservists had all been replaced by serving conscripts. (Apart from labour units – always heavily Asian – Soviet units in Afghanistan generally have no



A captured ex-DRA Army BMP-1 used by the Resistance in Zabul province. *(C. Broukenier via Committee For A Free Afghanistan)*

single dominant ethnic group, although the Baltic states and the Western Ukraine seem to provide more than their share of manpower.) Labour, logistic and transportation units have suffered a relatively high percentage of casualties, the Resistance having learned early on to attack them rather than combat units. By 1986 the Soviets were making efforts to increase the self-defence capability of these units.

Service in the Soviet military, harsh at the best of times, is particularly demanding in Afghanistan. This has led to serious morale and drug-abuse problems, especially in non-combat units.

Until about 1984, the Limited Contingent of Soviet Forces in Afghanistan received a twice-yearly draft, with untrained personnel being sent to units in much the same way as in Group of Soviet Forces Germany, for instance. Since then, however, combat-arms soldiers bound for the war have been put through a six-month course in a training division in the Soviet Union. Units in Afghanistan are no longer as tightly bound to the replacement-training-discharge cycle, and since 1985 have devoted more time to the war. The new emphasis on airborne units and special operations forces may result in part from their higher standards of training, fitness and competence.

The inability, except with small units, to use surprise effectively is still evident in combined-arms actions. Indeed, the Resistance is frequently advised of Soviet offensives long before the troops who will carry them out. Even when informers in the DRA or Soviet military cannot contact the Resistance, the Afghans have become adept at picking up such indications of impending action as the suspension of ordinary training and increased activity in vehicle parks. And when a combined-armed force goes into the field, Resistance messengers are still likely to move faster.

The application to the counter-insurgency war in Afghanistan of a system of tactics that remains largely based on the conventional warfare model has led to low efficiency. The Soviet divisions in Afghanistan in fact retain their full conventional warfare capability. This would explain in part such occurrences as the deployment of SA-7 surface-to-air missile launchers during the Panjshir V offensive in 1982.

A lack of effective intelligence has hindered Soviet tactics. It is also likely that the Soviets did not understand the nature of the Resistance, seeing it simply as a traditional guerrilla movement similar to those encountered in Central Asia. But while the Afghan movement has some similarities with the latter, it is also the largest national rising of the 20th century, with an Islamic motivation that gives it a degree of direction and unity unequalled by traditional guerrilla movements.

Most significant of the Soviet tactics currently evolving in Afghanistan are:

- Emphasis on political in preference to military tactics.
- Maintenance of pressure on Pakistan, to limit the availability of Resistance sanctuaries and to further regional ambitions.
- Maximum use of firepower. The Soviets have emphasised fire over movement, since they are better able to carry out adequate air strikes and artillery barrages than they are to conduct counter-insurgency operations.
- Recognition of the importance of helicopters for both firepower and mobility.
- Minimisation of Soviet casualties. An unwillingness to accept casualties has shaped Soviet tactics.
- Creation of an effective intelligence network.
- Defence of high-value targets.
- Destruction of the agricultural infrastructure.
- Creation and use of DRA forces.
- Interdiction of Resistance logistic routes.

The impact of Soviet tactics

While inefficient and brutal, Soviet tactics in Afghanistan also complement one another and offer several different ways of achieving the aim. The traditional demand for a systems approach and for overlapping and redundant capabilities has given rise to weapons and tactics whose use together makes the whole more than the sum of the parts.

There is no evidence that the Soviets had a clear-cut tactical approach in mind when they invaded Afghanistan. Nevertheless, the invasion was a clear operational and tactical success, pre-empting organised resistance by the DRA armed forces and giving the Soviets control of the cities, airfields and roads. But it did not extinguish Afghan resistance. The nature of this resistance, and the way to deal with it, have since emerged in the course of the war. The tactics that have emerged especially in 1984–86, appear to be a rational response to the problems of the war and not simply repeated fumbling to see what works.

Certain tactics have generated incidental benefits. The effort to increase the effectiveness of DRA forces, for instance, has also contributed to the legitimacy of the government and involved the populace with it, while at the same time creating divisions amongst the Afghans. The DRA militia is both a force suitable for the interdiction, hijacking or ambushing of Resistance supplies, and a source of agents for the intelligence network. The militia also increases pressure on Pakistan, because many of the Pathan tribes are trans-border in nature, and provides forces that can co-operate with both combined-arms offensives and special operations forces. Finally, its availability in peripheral areas reduces Soviet involvement and hence casualties.

Interdiction blocks movement of weapons and supplies into the interior. It is supported by destruction of the agricultural infrastructure, which channels Resistance movement, forcing them to carry their own food. This

The world's largest mechanised army runs into trouble. T-55 "119," still bearing its white invasion cross, was part of a tank platoon that ran into a minefield in Paktia province in early 1980. *(Committee for a Free Afghanistan)*

campaign also eliminates villages that could be used as staging points for attacks. It increases pressure on Pakistan by discouraging any large-scale return of refugees. It increases the effectiveness of special operations, driving out villagers who could give warning of the approach of Soviet forces. It contributes to effective intelligence by creating "free-fire zones" in which any movement seen by aircraft or sensors is likely to be the Resistance. Finally the driving of refugees to the cities and towns has the same effect as the resettlement campaigns of Western-style counter-insurgency wars, keeping the people apart from the guerrillas.

Combined-arms tactics

The basis of Soviet operational thought has been readiness for a high-intensity conflict – under actual or imminent nuclear conditions – in which military action would be decisive. Afghanistan, by contrast, is a low-intensity conflict which the Soviets believe will not be decided solely or even primarily by military action. Weapons and tactics have had to be adapted accordingly.

Combined-arms tactics in Afghanistan are carried out basically by conventional mechanised forces: tanks, BTRs, BMPs, artillery and aircraft. Heliborne forces, sometimes in multi-battalion strength, are used in support and, along with special forces, have come increasingly to act as the cutting edge of offensive operations. But the Soviets have not re-shaped their operational practice around the helicopter, seeing light forces as no more than complementary to combined-arms mechanised forces.

The Soviets have had great difficulty in adapting for a guerrilla war an army equipped, organised and trained for mechanised combined-arms combat in Western Europe or Manchuria. As a result, they have never dealt the Resistance a series of powerful, co-ordinated blows, and have never applied the full rigours of their operational and tactical thinking to the war. It is thus difficult to determine the extent to which Soviet tactics are simply inadequate and how much they are a reasonable approach to a war that must be fought on the cheap and in the long term.

The relatively small number of troops committed to Afghanistan has resulted in reliance not only on massive firepower but also on the application of high technology. In addition to the comparatively simple weapons normally thought adequate for counter-insurgency conflict, the Soviets have also used their latest systems, ranging from battlefield computers to SS-21 SSMs. Air power, SSMs and long-range artillery are employed both independently and in conjunction with combined-arms offensives.

The customary emphasis on the holding of vital terrain is not always apparent in the combined-arms offensives in Afghanistan. Though the Soviets do secure high ground along the route of offensives and sometimes leave outposts behind them, the fact remains that they have not added to the terrain seized in the initial invasion.

The initial Soviet operations in Afghanistan, in 1980, were characterised by conventional tactical thinking as a result of lack of experience in counter-insurgency warfare, a want of creativity and a desire for early, decisive results. The unexpectedly universal nature of the Resistance and widespread desertions from the DRA Army added to the difficulties.

Afghan guerrillas on a knocked-out T-55. Spare track links, seen here on the tank turret, were a commonplace form of appliqué armour until replaced by steel "horseshoe" turret armour in 1985–86. The man on the far left carries an SA-7b launcher. *(Nabi Wardak)*

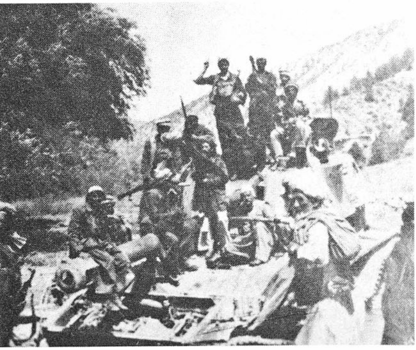
In 1980 offensives were carried out by mechanised combined-arms forces moving along major roads with helicopter and artillery support. Using extensive reconnaissance by fire as they advanced, they made little effort to secure high ground along the route of advance or to conduct any ground reconnaissance. Combined-arms tactics were poor and the motorised riflemen were reluctant to fight dismounted, even when the Resistance took up exposed positions.

In 1981 combined-arms offensive tactics were modified to compensate for the lack of competence at low levels of command. Major forces leapfrogged between firebases, where artillery would be deployed. As the mechanised forces advanced, they would be preceded by extensive air and artillery preparation. That year also saw the start of the use of heliborne forces either to "crest the heights" when operating in conjunction with combined-arms forces or to carry out independent offensive operations. Combined-arms or DRA forces were used as blocking forces to cordon an area while heliborne forces move in.

Heliborne operations – by companies and, more frequently, battalions – became more common in 1982. By then it had become apparent to Western observers that, despite the size and scope of the Resistance, the Soviets were seeking a long-term solution that would be primarily political, economic and diplomatic in nature. Casualty rate and expenditure were to be minimised, and there was to be no major escalation.

1983 saw an increase in the use of firepower against the agricultural infrastructure. The following year this was coupled with a much higher operational tempo: no longer would much of Afghanistan be spared the direct impact of war. Starting with the relief of the besieged fort at Urgun, there were more large-scale combined-arms offensives, extensive employment of special operations forces, and increased interdiction. This approach was sustained through 1985, with long-range artillery being brought into the campaign against agriculture. Increased Resistance in the border areas resulted in big Soviet offensives to relieve beleaguered DRA outposts, interdict supplies and put pressure on Pakistan. In 1986 there was a Soviet-backed

In 1967–70 11.6% of US Army helicopters shot down in Vietnam fell to RPG-7s (33.7% of those hit were lost). Soviet helicopter losses in Afghanistan probably follow a similar pattern. *(Dr Khalid Akram)*



Left: This 2S3 152mm SP howitzer was part of a battalion-sized Soviet column when it was attacked while fording a stream near Sekhunderkhel, Paktia province, Afghanistan, during the abortive relief of Khost in September 1985. The 2S3 bogged down and was captured by the Resistance. *(Rahmatullah Safi)*

Below left: Resistance B-10 82mm recoilless gun in action near Khost in 1985. Note return fire in background *(Dr Khalid Akram)*

trans-border tribal rising, and the first efforts to develop a usable DRA operational capability.

While the combined-arms offensives in Afghanistan have never been based on more than a reinforced division, they still receive the level of command, control and co-ordination of independent army operations. This is in part due to their scope: 100km wide, 200km deep and lasting three to four weeks in the case of those in 1985. Only one such offensive is mounted at a time, making it easier to exert high-level battlefield control.

Air mobility and air resupply have been vital. They made the invasion possible; have allowed the Soviets to accept limited control of the road network; and have permitted garrisons and district and provincial headquarters to exist as islands in a Resistance sea. When the Soviets attack to relieve a besieged garrison, they first fly in reinforcements for a break-out. This has been seen numerous times, from Urgun in 1980 to Khost in 1985. As a result, garrisons seldom fall, except in the north.

In the 1985 Kunar and Paktia offensives, which took place in mountainous country, the use of heliborne troops to take and secure high ground was crucial. The emphasis in Soviet mountain warfare tactics on simultaneous strikes from several directions against enemy strongpoints has been made practicable by the availability of heliborne forces, as have traditional cordon-and-sweep counter-guerrilla tactics.

In the June 1987 offensive in Paktia province, the presence of substantial numbers of Stinger SAMs forced the Soviets to curtail helicopter operations in the combat area. MRL barrages were used instead of Hinds to give supporting firepower. Helicopter insertions of troops on high ground were limited, leading to advances even more slow and costly than before.

The offensives in Afghanistan have resembled more "conventional" efforts in their application of firepower throughout the area of operations. Offensives such as Panjshir VII in 1984, Khost in 1985 and Zhawar in 1986 were preceded by massive air strikes more appropriate to sophisticated, mechanised opposition. The dispersion of Resistance forces and the decentralisation of their logistics and command structures, coupled with problems of target acquisition, meant that these strikes were largely ineffective. They have since been replaced by saturation attacks against the population as a whole, which are less affected by target-acquisition problems and contribute to the destruction of agriculture.

Combined-arms offensives such as the relief of Barikot and the attempted relief of Khost in 1985 included the use of militia forces along the flanks and, along with Soviet mechanised battalion-size forces, as enveloping detachments. Permanent outposts, held for the duration of the operation, were established along the route. DRA and militia posts have been built after offensives to cut Resistance supply routes, and are supported by bases containing Soviet artillery and tanks.

The militia is also the first line of defence for the Soviets in Afghanistan. Along with long-range firepower, delivered by air or artillery, and special operations forces, it allows the Soviets to operate in areas beyond their limited

physical control without having to mount full-scale offensives. The militia is also interposed between Resistance strongholds and high-value targets that must be defended.

The relatively slow tactical tempo of the Soviet Army has been apparent throughout the war. This is perhaps surprising in an army that places such emphasis on surprise, speed, shock and manoeuvre, but can be largely explained by a reluctance to take casualties. Another reason is the terrain: the slow rates of advance in the 1985–86 offensives actually accord with Soviet expectations of mountain warfare.

The Soviets have always stressed the primacy of firepower in Afghanistan. In pre-1984 combined-arms operations it was applied at the expense of manoeuvre, speed and shock. There was little reconnaissance and few efforts to use flanking forces or move against guerrillas beyond direct-fire range of the roads. "Cresting the heights," holding high ground along the route of the column, was sometimes accomplished by heliborne forces but more often ignored.

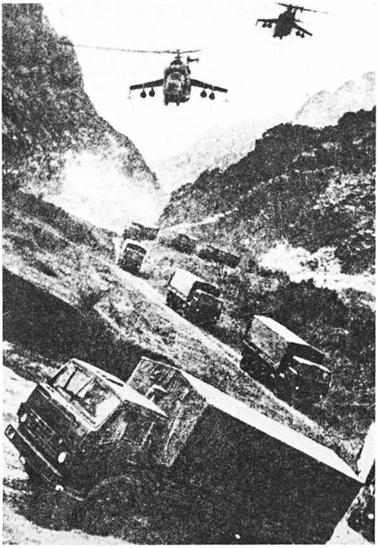
In 1981 the Soviet response to the ambushes suffered by their roadbound combined-arms offensives was not to stress manoeuvre but instead to increase their firepower. The columns, still roadbound, were then preceded by intensive artillery and air strikes. Artillery firebases, with both howitzers and MRLs, were established 15–20km apart as the columns slowly advanced. But the Resistance soon learned to let mechanised columns roll past and then return to hit the supply convoys at the end of the day. The resumption of large-scale combined-arms offensives in 1982 saw an intensification of the "scorched earth" attack on agriculture, with increased use of landmines and boobytraps.

Many of the former Afghan military men now with the Resistance trained in the Soviet Union and worked with Soviet trainers and advisers before the war. They observe that the Soviets did not use the sort of tactics described in pre-war writings until 1983–84. That the Soviets were in fact often not capable of implementing their own teachings is apparent from a range of reports from Afghans and Westerners alike.

The campaign against the agricultural infrastructure

Soviet counter-insurgency warfare has always incorporated attacks on agriculture and infrastructure, as in the Ukraine and Central Asia. The depopulation of the countryside of Afghanistan has been pursued systemati-

Aftermath of an Afghan guerrilla ambush: MAZ-500A tanker truck burns. These vehicles are a frequent target; one ambush near the Salang Pass in the spring of 1984 yielded 25 large tank trailers destroyed. *(Committee for a Free Afghanistan)*



A convoy of KamAZ-5320 trucks in Afghanistan with its vital Hind escort overhead. Major convoys usually had helicopter escort until 1987, when Stinger SAMs forced the adoption of more cautious tactics.

cally since mid-1980. Most villages between the paved roads and the first or second line of hills – almost all the roads in mountain areas run in valleys – and those within striking range of targets such as cities, airfields, garrisons and pipelines have been destroyed. The area within a day's march of the roads and other targets is the target for most of the bombing and ground sweeps. While guerrillas still operate in such areas, they must normally stay concealed, frequently in caves, if they are not on the move. Agriculture is difficult, and most civilians have left. Anything beyond a day's march of the Soviets' high-value possessions is regarded as the hinterland. They bomb and sweep there only in response to intelligence information of guerrilla activity or food production.

While the devastation is readily apparent, it is often regional and fragmented in nature, rather than appearing to be the product of a long-term, nationwide policy. Thus agricultural losses in one area are often made good to an extent by transporting foodstuffs from another area or across the border, although the interdiction campaign has succeeded in making this more difficult and costly. Similarly, while attacks on villages by Air Force helicopters and fighter-bombers have been frequent, a sustained and massive bombing campaign by aircraft like the Tu-16 Badger or modified An-12 Cub would have achieved even more destruction.

Some occupied areas are not devastated, while others, not noticeably more significant, are razed. There have been reports of one side of a valley being put to the torch while the other was spared. The agriculture of the Panjshir Valley was not thoroughly destroyed when the Soviets occupied much of the main valley in the 1982 offensives. After the 1984 offensives, however, the valley suffered greatly. Swept areas have shown remarkable resilience, however, the Panjshir Valley being the best example of this. Areas have survived multiple sweeps, though it appears that the effect of these actions is cumulative and could ultimately be decisive. The destruction of agriculture appears to be less severe in the north-west, in keeping perhaps with the policy of economic integration of this area with the Soviet Union.

Interdiction

In contrast with the intensive interdiction and anti-infiltration campaigns that have marked many post-1945 counter-insurgency campaigns, such as Algeria and Vietnam, the war in Afghanistan was not originally characterised by a high emphasis on interdiction. By 1985 this had changed, probably in reaction to increased Resistance activity in the interior. In 1984 the Soviets had failed in their attempt to defeat the Resistance in the Panjshir, despite an offensive by a division-sized force of paratroopers. Other Resistance strongholds proved similarly intractable, and interdiction may have offered a way of weakening them.

The continued Resistance attacks on Kabul – especially those that spoiled the People's Democratic Party of Afghanistan anniversary celebrations in January 1985 – not only led to the strengthening of the capital's defences to include a triple ring of outposts designed to keep the Resistance out of 107mm rocket range, but might also have warned the Soviets of a trend that looked likely to continue unless they acted to interdict the flow of munitions and food. Since then the campaign has been prosecuted rigorously by the militia and by combined-arms, heliborne and special forces; interdiction was the primary mission of the last-named in 1985–6.

The Soviets frequently use outposts to safeguard their own supply routes, especially on the Salang Pass highway, where they are sizeable installations with artillery batteries, helipads and quick-reaction forces. Elsewhere, outposts are usually manned by DRA forces. In 1986–87 the Soviets started to use permanent outposts offensively, as part of the interdiction campaign. These are frequently established on the peaks of mountains overlooking

A Hind-E attacks a target in Afghanistan. Soviet helicopters are the most feared weapons in the war. Starting in 1987, however, the use of Stinger SAMs by the Resistance forced the Soviets to use artillery instead of helicopters for some tasks. *(US Information Agency)*

Resistance supply routes, surrounded by thick fields of surface landmines, and resupplied by helicopter. Helicopters also bring in pre-cast concrete structures for overhead cover. Troops manning these observation posts use optical and electronic sensors to detect Resistance movement and then call in air strikes or special forces.

While the interdiction campaign begun in 1985–86 is a great deal more serious and systematic than those of previous years, it is still by no means equivalent to the US South-east Asia effort.

It may be that at that point the Soviets were in fact satisfied with the way things were going in Afghanistan. This is suggested by the fact that the operational-level commanders most closely associated with the war have thrived in the hierarchy. This by itself is of course not decisive evidence, for it is likely that many of these marshals and generals were assigned to the war because they were known to be rising stars, rather than being transformed into such by their performances. However, Afghanistan veterans are also being held up as worthy of emulation at tactical levels of command.

In 1987–88 the situation started to change. The Soviets expressed greater interest in a political settlement and a withdrawal of forces. At the same time, they remained capable of settling in for the long haul, infrastructure improvements continued, and escalation remained a possibility. However, the war was becoming increasingly costly and unpopular in the Soviet Union, and it was no longer clear whether time and attrition would mean an inevitable Soviet victory. As of February 1988 a withdrawal remained nothing more than rhetoric, though there were signs that it could become a genuine policy goal.

In the meantime, efforts at consolidating the Soviet position – economical as well as military – in north Afghanistan continued. Increased pressure on Pakistan included a large-scale terror campaign orchestrated by WAD. Politically, the Kabul regime remained no more legitimate among Afghans or the world at large, despite announcing a policy of "national reconciliation," adopting a new constitution and renaming the nation the Republic of Afghanistan. In 1987 attempts to create an independent DRA operational capability crumbled in the face of increased Resistance strength and DRA factionalism.

The introduction of Stinger and Blowpipe SAMs, starting in late 1986, altered the face of the war. It also raised questions about the viability of the Soviet helicopter force in a European conflict, when it would face a wide variety of air defence systems in the hands of well trained troops. But although losses were high – 150–200 aircraft in 1987 – the Soviets were still able to keep control of the air. Operations were curtailed in many areas, however, and helicopters flew under the Stinger's minimum altitude or at night, and used existing countermeasures or, on Hinds, the LIB missile bearing and warning system. Many missions – close air support, resupply of garrisons, convoy escort, tactical mobility – were severely reduced. Fighter-bombers (and, in the north, Badger bombers) attacked at night or from high altitude, reducing accuracy. Use of artillery was increased to compensate for the loss of airborne capability. Smaller operations, both heliborne and ground sweeps, were limited in favour of a few large-scale offensives. The threat to air resupply led the Soviets to evacuate a number of garrisons, concentrating their forces. Isolated garrisons became a DRA responsibility, surviving largely because of their thick minefields.

Special-operations patrolling and independent operations by special-operations forces, especially for interdiction purposes, were less aggressive. The use of larger patrols resulted in a loss of effectiveness, and helicopter support was limited. Soviet special-operations forces suffered a severe battlefield defeat in the June 1987 Paktia offensive. They fared better in the December 1987 Khost offensive, backed by artillery and the successful use of heliborne and enveloping forces in the mountains; as elsewhere, supporting militia forces proved unreliable. The Khost success – along with the fact that in 1987–8 Kabul, Mazar-e-Sharif and Jalalabad were relatively secure (Herat and Kandahar remained combat zones), road convoys were not systematically blocked and major garrisons did not fall – suggests that the Soviets are still capable of a long-term war.

Ethiopia 1978

The Soviets have been involved in many wars since 1945, sending weapons and, often, advisers. Air Force fighter regiments were committed to combat in Korea and the

Middle East in 1970. The use of Cuban troops as surrogates in Angola, Grenada, Syria and elsewhere is a demonstration not only of Cuban foreign policy but also of the Soviets' reluctance to commit their own ground forces. It was apparently not until the Ogaden War of 1978 that the Soviet Army exercised full operational control in a Third World conflict, though the majority of the troops were not Soviet but Cuban and Ethiopian.

Setting the stage for the Soviet involvement in the 1978 Ogaden campaign was the emergence in February 1977 of a pro-Moscow regime in Ethiopia under Colonel Mengistu. Then came the July 1977 Somali invasion of the Ogaden region of Ethiopia, on which Somalia had long-standing claims. Finally, in November 1977, Somalia abrogated its 1974 treaty of friendship and co-operation with the Soviet Union, which had led to the supply of weapons and the presence of over 1,600 advisers.

The Somali offensive, carried out with Soviet-built armour, encountered little resistance and achieved some territorial gains at first. But by November 1977 it had bogged down. The Soviets then began to move into Ethiopia, providing commanders, weapons and troops. The commanders were first to arrive. In November 1977 General Vasili Petrov, then First Deputy Commander of the Soviet Army, was despatched to Ethiopia. He was joined by Colonel-General Gregorii Borisov, who had until November been chief of the Soviet military mission in Somalia. They were soon followed by massive sea and air arms shipments, including 300–400 tanks, 200–300 BTRs and BMPs, and over 100 MiGs.

The accompanying troops included 1,500 Soviets, mainly aircrew and technicians, but were mostly Cubans airlifted from Angola or directly from Cuba. The Cuban presence totalled 12,000 troops in the first year, rising to 17,000 in the next year, and later declining to 10,500 by 1984.

Starting in the autumn of 1977, the Soviets provided intelligence support for the war, launching dedicated reconnaissance and communications satellites. They also trained the Ethiopians and Cubans on the new weapons that had been delivered. But their most important contribution, and the one that made the Ogaden essentially a Soviet offensive, was the supply of commanders. Petrov's counter-offensive to recapture the Ogaden, launched in early February 1978 after a preparation and interdiction campaign in late January by the Soviet-supplied Ethiopian Air Force, was based on a wide flanking movement combined with a direct push against Somali positions, especially those around Jijiga and Karamarda Pass. The Somali forces were at the end of a precarious supply route, and were suffering from poor equipment serviceability as a result of the withdrawal of Soviet advisers and spare parts.

The power of the Cuban and Ethiopian forces was demonstrated in the early battles of the campaign, and they continued to advance throughout February. In addition to main thrusts by two combined-arms ground forces, aircraft and helicopters flown largely by Soviet aircrew were used to insert units to secure the flank of the outflanking force, clear the rail line to Djibouti, and spearhead the attack on the main Somali defensive positions around Jijiga. The Cuban paratroopers were reported to have been reinforced by no fewer than 70 ASU-57s, BMDs and other heavy equipment delivered by 10 Mi-6 helicopters in 100 sorties. Jijiga was cut off by this force and fell in early March to a combined frontal and rear attack. Somalia started to withdraw its forces soon after this defeat.

The Ethiopian and Cuban forces went on to participate in the continuing counter-insurgency war against the people of Eritrea and Tigre, and the success of Petrov and Borisov was recognised by their subsequent commands: Petrov commanded the Far Eastern TVD and then became Commander-in-Chief of the Army, Borisov commanded Central Group of Forces.

The lessons of the Ogaden campaign, which left the Soviet Union the dominant power in the Horn of Africa, are significant. It showed that Soviet operational commanders are likely to be as capable as their predecessors of 1944–45. It demonstrated that Soviet operational art can be applied throughout the world and with a variety of forces. Finally, it revealed that the Soviets are willing to export more than weapons and advisers to Third World conflicts, providing surrogate troops and top-rank commanders if major interests are seen to be at stake.

Even though the combat troops were not their own, the Soviets showed in the Ogaden War an ability to translate material superiority to tactical advantage. This was made possible by massive air and sealifts. They also demonstrated a readiness to use manoeuvre and outflanking movements instead of purely frontal attacks, and their employment of vertical envelopment by parachute and, especially, helicopter was particularly significant. The Soviet emphasis on vehicles suitable for use by air-inserted mechanised forces yielded dividends at Jijiga.

Angola

The war in Angola has not seen anything like the same degree of Soviet commitment as the Ogaden campaign, despite the continued presence of large numbers of Cuban troops. It nevertheless remains significant because of the size and scope of the advisory mission, a key element of Soviet tactics in the Third World.

The military commitment to the Luanda regime goes beyond the supply of hardware and supervision of the management and training of the Angolan Army. It is possible that Soviet soldiers actually take part in some of

the fighting. In early 1985, for instance, the Soviet press reported on "specialists" in Angola who "live in battlefield conditions" and "work under fire". The fact that Soviet prisoners, both aircrew and ground forces, have been taken in Angola indicates an active role in the conflict. Reports of *Spetsnaz* activity in Angola are unconfirmed, however.

While not participating at the level seen in the Ogaden, the Soviets appear to play a part in overall planning. A March 1985 high-level Soviet-Cuban-Angolan meeting in Moscow, presided over by Soviet Defence Minister Sokolov, probably decided on that year's plan of campaign, although its execution remained in the hands of the Angolan and Cuban commanders in-country. Similar planning is reported to have preceded the disastrous 1987 campaign.

Soviet arms supplied to Angola have been increasingly sophisticated, indicating that the readiness to use high-technology weapons in counter-insurgency wars is not limited to Afghanistan. The advanced nature of these weapons does however entail a significant support commitment. As well as MiG-23 Flogger-E and Su-22 Fitter-H fighter-bombers, advanced systems delivered to Angola included Mi-25 Hind-Ds, SA-8s, SA-9s, SA-13s, SA-14s and mobile radars intended for defence against South African aircraft.

Grenada 1983

Soviet military advisers were on Grenada during the 1983 fighting. At the time there were unconfirmed reports of their participating in actions against US and Caribbean forces. However, the short duration and limited scope of the operation ruled out air reinforcement from the Soviet brigade in Cuba. Grenada underlines the continued importance of military advisers to Soviet foreign policy. This may in the future be reflected in adaptations of tactical thinking to such contingencies.

BTR-60PBs knocked out by the 90mm recoilless rifles of US Army Rangers on Grenada. Most of the Soviet-bloc hardware used in the fighting was low-technology equipment combining robustness with simplicity. *(US Army)*

Chapter Seven

Behind the weapons

"The general must know how to get his men their rations and every other kind of stores needed in war. He must have the imagination to originate plans, practical sense and energy to carry them through."

SOCRATES

Logistics

The effectiveness of Soviet weapons is directly dependent upon the effectiveness of the logistic system that supports them. Soviet logistic capabilities have been significantly improved since the 1968 invasion of Czechoslovakia, which revealed many shortcomings in the system. Today, while there are still weaknesses in both the means of logistic support and the way they are used, it is no longer possible to regard logistics as the pervasive Achilles heel of the Soviet Army.

Changes include the provision of item-specific artillery ammunition resupply systems and, in the mid-1980s, the combination of supply and transportation into one by creating, at division and army levels, material support battalions and brigades respectively. The latter are amalgamations of existing transportation and all non-maintenance support and logistics units under a centralised commander, who is in charge of executing the plans of the Chief of the Rear. The centralisation of the non-maintenance support – divisional bakery, storage, support base and transportation battalion in the case of a division – makes it easier to tailor assets for assignment to sub-divisional forces, thereby making extended operations by such forces possible.

The Soviets have stressed that these new units must function in the face of a wide range of "deep battle" threats, including special operations forces. The creation of the new units has been accompanied by an increase of some 30% in Soviet truck strength. At the same time, increased computerisation has been applied throughout the logistics system. From the management of supply flows in a fast-moving situation, to the maintenance logs of individual weapons, computers are playing a larger role in Soviet logistics.

The invasion of Afghanistan in 1979 did not see a repeat of 1968's logistics failures. The problems encountered in the mobilisation of the western military districts against Poland in 1980–81 appeared to be linked mainly with reliance on mobilisation-only assets for logistics. This in turn has apparently led to further changes, including an emphasis on the military districts' obligation to deploy forces outside their territory, to give them sustained logistic support subsequently, and to streamline and keep in place in peacetime the higher headquarters that would be in charge of logistics at the TVD level.

Parallelling and co-equal at all levels to the Chief of the Rear is the Chief of Armaments and (in some units) Chief of Technical Matters, responsible for maintenance, repair and support for major weapons.

Soviet divisions and below have a much more highly developed supply system than the US Army. On mobilisation, fronts will receive extensive logistic assets. In addition, there exist enormous "central" logistic systems above military district level. The Soviet delivery-forward logistic system specifies that higher levels of command have increasingly powerful resources and more extensive stocks. Supplies flow from the rear front-level base, to the front's material support brigade, to the army's material support brigade, to the division's material support battalion, and to the regiment's material support company, skipping echelons whenever feasible or desirable. Apart from the trucks belonging to each base or brigade, there are additional vehicles dedicated to moving supplies forward.

The Soviets have also assigned to the civil sector many functions that in the West are a military responsibility. The reliance throughout the Soviet Army on mobilised civilian trucks is the most obvious example of this. Others include the use of railways for both operational mobility and resupply. Civil communications systems all have military applications upon mobilisation.

The aim of Soviet logistics has been to provide what they consider an acceptable level of logistic self-sufficiency, creating operational flexibility. A division, possibly with some army-level augmentation, can carry a five or six-day supply of ammunition, POL, rations and other requirements. The six days' supplies held at division will not be expended for as long as the chain from higher echelons is functioning. Another one or two days' stocks are held at army level. Army-level headquarters and service

support units act as a conduit for supplies coming forward from front level, which can expect to receive them by rail from the Soviet Union. The war envisaged by the Soviets could include two or more successive front operations. Soviet stockpiles in East Germany, exclusive of those with their units, contained in the late 1970s 37 days' supply of ammunition and 16 days' supply of petroleum products, oil and lubricants. By the mid-1980s a 60–90-day level of total stockpiles was believed to be held in the four Groups of Forces and the Soviet border military districts. Estimated stocks included 60 megatonnes of POL, 12 megatonnes of arms and ammunition, and 27km of bridging material, much of it in hardened depots. The various categories of state reserves in the Soviet Union are large enough for them to fight on even if strategic strikes destroy much of their production, refining and fabrication plant.

Military districts are structured as miniature war economies not only to assure this logistic flow in wartime – their headquarters may spawn front-level headquarters but do not themselves shut down – but also to assure rear area security and support so that the material gets through. Their logistics and war penetration role was best illustrated by the mobilisation in the military districts bordering Poland, first reported in August 1980. By late 1980 Category II divisions were being brought up to strength with reservists, and large-scale command and control exercises covered the activation of higher headquarters.

The Soviet logistic system, operating through the military districts, remains by design mobilisation-dependent. However, after the problems of the Poland mobilisation, the command system has become less so, with TVD commands, headquarters and communications systems now permanently in place.

The principles of Soviet logistic support include centralised planning at the highest possible level of command, forward delivery (each level of command is responsible for deliveries to the next lowest level), maximum use of bulk transport systems (especially railways and pipelines), building up stockpiles, positioning service support units as far forward as possible, setting up and adhering to a strict system of priorities, and minimising overall requirements and frequency of resupply. The demands of these principles have been built into Soviet weapons and tactics.

All Soviet service support elements are under the command of the *tyl*. The *tyl* refers to both the central Rear Services, which provides for strategic-level support for all armed services in the Soviet Union and is charged with getting supplies of all types to the theatres of operations, and to the service support elements found at each level of command from TVD or front down to battalion; each unit has its own "chief of the rear," the deputy commander for service support functions, who controls all service support activities from the unit's rear command post. This system allows for high-level centralisation of authority and priority decisions, while retaining the ability to adjust these directions in accordance with local conditions. Each chief of the rear is responsible for the day-to-day administration of his unit's logistics. He is assisted by a staff of officers from combat and technical arms as well as those from service support forces. Thus the tank directorate of a division's *tyl* (which, like the Tank Directorate of the central *tyl* in Moscow, is manned by men of the Tank branch) is responsible for the supply and maintenance of all AFVs, although the artillery directorate is responsible for all guns, including those on tanks. Similar directorates embrace each of the varied tasks of the *tyl*, including those for the Military Transport Service (VOSO), and many others.

Soviet logistics units, planning and activity are concentrated at front and army level, freeing divisions from many support requirements. The forward distribution system starts at the front-level supply base, 250–400km behind the front lines. Whenever possible, supplies will be moved there by rail. The front support base will include extensive depots and workshops. In a mobile situation detachments of the front material support brigade will be pushed forward behind the advancing troops. The army material support brigade, about 100km behind the front, is similar to that found at front level but is smaller. The Soviets will try to provide rail links to army level, but intend to rely principally on truck convoys moving forward from front base. The army support base will also establish forward detachments when its troops are advancing rapidly.

At division level all depots will be kept on trucks whenever possible, although dumps will be established when breakthrough attacks are planned. The division supply base will be positioned 25–40km behind the front lines. Combat vehicles will usually be loaded with fuel and ammunition from trucks at the regimental supply point, 10–30km behind the front. The regimental chief of the rear (the lowest level considered capable of supporting independent operations) has a small staff. Supplies are also brought from regiment to battalion support elements, and the battalion chief of the rear will resupply the individual companies, often just out of contact with the enemy. Each company will, like a battalion, have supply points for ammunition and rations, and a medical post.

This supply flow is subject to a strict priority system. Ammunition, POL, spares, rations and medical supplies are normally supplied in that order, with lower-priority items being dispensed with if the flow is impeded. The priorities can be changed in some situations: in a fast-moving pursuit, for instance, fuel may have priority

over ammunition. Similarly, those units making the main attack get first priority for supplies, while divisions and regiments in secondary sectors may even have to send their own transport back to get whatever they have been allocated if all the forward delivery is going to the crucial sector.

Armies usually hold a two–three-day supply of POL, fronts a 12-day supply. As elsewhere, the Soviets concentrate logistic functions at echelons above division, using reservists in the main. Divisions carry a three–five-day stock of fuel.

POL supply is expressed in tonnes but planned in terms of "fills": the number of times a unit can refuel all its elements. Armies usually hold two fills in their POL depots, which may be increased to three or four if time permits extensive dumping. Divisions hold one or two fills, and regiments hold 0.70–0.75 of a fill, formerly 0.5 of a fill. Each vehicle holds a fill in its internal tanks and often another 0.5 fill in external tanks.

Normal POL distribution is:

Tank army/div/regt/bn:

4,000 (11,000)/800 (1,700)/120 (240)/25 (40)

MR army/div/regt/bn:

5,000 (17,500)/700 (1,450)/90 (160)/9 (11)

All numbers are in tonnes, the first figure showing the fuel carried in organic vehicles and the second figure, in parentheses, the fuel carried in unit trains, depots and dumps. It has been estimated that a motorised rifle division requires 190–220 tonnes of POL a day to maintain itself in the field, and 500–600 tonnes in the offensive.

Whenever possible, front and army supply bases will receive their POL through pipelines. The Pipeline Troops are a separate branch of the *tyl* of the Soviet Union and the Soviets put great emphasis on them. They include both standard pipeline construction units and mobile pipeline-laying units. A pipeline construction brigade of several battalions is attached at front level, and builds forward to reach the army supply base. A brigade can lay 70km of pipeline a day, and a completed pipeline can transport 2,000 tonnes of fuel a day.

POL is distributed to units in special tank trucks and bowsers and in tank trailers. When the demand for fuel is heavy, or if specialised trucks are not available, standard cargo trucks will carry POL in drums and, increasingly, flexible blivets (plastic storage tanks).

Ammunition is supplied in terms of units of fire, the number of rounds in a unit of fire differing for each weapon. It is purely a logistical and planning factor rather than a tactical one, although ammunition expenditure limitations are also expressed in the same terms. Each artillery-type weapon has a mixture of ammunition types in each unit of fire. There are also special chemical units of fire, normally held at division or higher levels. Tanks and AFVs carry one unit of fire on board. Another 0.5 unit per tank or AFV is divided between battalion and regimental transport, and another 0.5 unit is held at division. Artillery has one unit of fire with the gun, one at battalion/regimental level, and 0.5 unit at division. Assault rifles, light machine guns, RPGs and other infantry weapons have half a unit carried by the user or his fellow squad members, 0.5 unit is held at battalion/regiment, and 0.5 at division.

Units of fire expended per day

Action	Inf wpns	Arty, MRLs	Tanks, ATGMs	AAA	Mines, grenades
Attack on position	1.0	2.0	1.5	2.0	1.0
Meeting engagement	0.5	1.0	1.25	2.0	0.5
Pursuit	0.25	0.25	0.25	1.25	0.25
Delaying action	0.5	1.5	1.25	2.0	0.5
Withdrawal	0.5	0.5	1.0	2.0	0.5

In the Second World War 40% of the time taken to get a shell from the factory to the gun was spent loading and unloading in transportation. Even today, the Soviet system of successive levels of forward supply means that a shell may first be taken by rail to a front-level supply base, unloaded, then reloaded and trucked to army level, unloaded, reloaded on to a truck belonging to the army headquarters' transport assets, trucked to division, where it is unloaded and reloaded on to a divisional truck, and taken to regiment, where, if required, it could even be reloaded again. The trucks used throughout this transhipment are all standard Soviet cargo types – KamAZ series, Ural-375, ZIL-157, ZIL-151 or ZIL-131 – but they are tied to their parent unit and will not go beyond their forward boundaries to deliver supplies directly to the user. The Soviets have realised the inefficiency of this system, and are capable of moving supplies in a skip-echelon mode, as well as trying to provide tactical units and sub-units with tailored supply packages. Skip-echelon supply lines allow fronts to supply divisions, and armies to deliver supplies directly to regiments, especially those engaged in combat.

Static dumps will not be possible in many mobile situations, and keeping the supplies on wheels at each level below army will strain their relatively thin transportation assets; the Soviets still have fewer trucks per fighting man than Western armies. The traffic jams of trucks bringing supplies forward and those acting as mobile supply columns will be extensive, especially if roads have been cratered, bridges blown or choke points blocked, or if the columns are subject to air interdiction. While the Soviet Army's tank and motorised rifle units have a high degree of

cross-country mobility, the supply trucks on which they depend are still tied to the road network.

The Soviet concepts of operational military art and service support have attempted to minimise the logistic requirement. This is even reflected in Soviet tactics. The increased use of direct fire will reduce logistic requirements if, as the Soviets claim, it allows one accurately placed shell to do the damage of ten fired in standard indirect fire. Similarly, the amount of ammunition which can be expended in certain situations is strictly limited, and each unit or vehicle has an emergency reserve, usually 10–15% of a fill or unit of fire, which cannot be expended without orders from the next highest level of command.

The Soviet system of forward distribution requires that all units from front down to battalion have their own motor transport. Each army material support brigade will have one or more motor transport regiments with perhaps 1,000 or more trucks per regiment; these are intended to carry the burden of the "delivery forward" to the fighting divisions. At all levels, the Soviets make maximum use of trailers, now increasingly used with loads pre-packaged for specific types of unit.

As well as service support elements, each front has a tank transporter regiment with 300 16-tonne MAZ-537 heavy tank transporters, which can also be used to haul bulk cargoes and large palletised shipments. The Soviets did not emphasise tank transporters for many years, preferring to rely on rail transport. The increased emphasis on troop manoeuvre in about 1967 and, possibly, the lessons of the 1967 Middle East War (when the transporterless Egyptian Army was decimated in the course of its disastrous motor march into Sinai and the Israelis used transporters for tactical and strategic mobility) led to the introduction of the MAZ-537. A tank transporter regiment can carry most of the tracked vehicles of a divison 500–600km per day without wear.

The course of the war in Afghanistan has been shaped by logistics. As throughout the Soviet Army, there is an effort to minimise what needs to be brought forward. As a result, conditions of service, bad at the best of times, are often very rough indeed in Afghanistan. The country's proximity to the Soviet Union also influences logistics. Unlike the United States in Vietnam or the French in Algeria, the Soviets do not have large service support elements in-country. Instead they are deployed across the border, in the garrisons at Kushka and Termez and other locations on the railway lines. Equipment needing major servicing is withdrawn to the Soviet Union.

Soviet early-war logistics efforts in Afghanistan were characterised by poor traffic management, bad maintenance and heavy non-combat casualties. Truck convoys are reported to have taken "weeks" to travel from Termez to Kabul. When the invasion started, the Soviets were in the midst of their reorganisation, combining motor transport battalions and regiments and rear supply base structure into material support battalions at division level and material support brigades at army level. All of this contributed to a heavy reliance on airlift resupply early in the war. Logistics facilities were then expanded at Termez and Kushka in the Soviet Union and Pul-i-Khumri in Afghanistan. The Pipeline Troops deployed the first POL pipelines and have since been kept busy repairing them.

The problems encountered in Afghanistan, where the logistics personnel are serving troops, must raise serious questions about the Soviet ability to sustain fast-moving conventional operations in Europe in the face of intensive interdiction and with a logistics force consisting largely of mobilised reservists.

Logistics may limit the Soviet capability to escalate the war, it being possible that a major increase in troop numbers would require substantial improvements to the infrastructure. Large convoys – comprising several hundred trucks with heavy escorts – run a number of times a week to carry most of what is needed into Afghanistan. The most important convoy route is the western one, via Herat, Shindand, Kandahar and Ghazni. The shorter, more direct route to Kabul, via the Salang Pass tunnel, is also heavily used but is subject to more intense guerrilla attacks, one of which destroyed 25 POL tractor-trailers and cut the road in the spring of 1984. By 1986–87, half of the Soviet truck tonnage going into Afghanistan was using the Salang Pass route, in heavily escorted convoys of over 400 trucks. Spacing is 40m between vehicles, and convoy speed is 40km/h. The use of gun trucks – up to one for every ten trucks – is reported to have been successful. Nevertheless, airlift still makes up a substantial part of Soviet resupply efforts. Airlift is used for priority items and, as in Eastern Europe, personnel rotation. The forces in Afghanistan have a degree of airlift support beyond that possible in a more general conflict.

As in Eastern Europe, the Soviets have made an effort to expand their stockpiles in Afghanistan. There are reports of underground POL and water storage being installed in bases near the Iranian border. Water supply has become a major logistics problem in Afghanistan. In the north most of the Soviet Army's water must be trucked in, and some garrisons have been abandoned through lack of water.

As in any counter-insurgency campaign, tactical logistic support is difficult in Afghanistan. Many of the DRA garrisons, especially along the borders, can be supplied only by air, and some of these only by airdrop or helicopter. Soviet forces in the field are resupplied by helicopter or convoy. The Afghans have become adept at letting Soviet mechanised forces roll by and then ambushing the inevitable following convoy.

Maintenance

Soviet weapons, simple and rugged, have traditionally had

a lower maintenance requirement than their Western counterparts. In the Second World War, despite their shortage of trained personnel, the Soviets were able to repair 75–80% of their disabled vehicles, 80–90% of these within two days, a performance similar to that achieved by the Israeli Army. Today the sophistication of Soviet weaponry is increasing, and with it the maintenance requirement. A laser rangefinder cannot be built like the Dnepr Dam, big, coarse and rugged. The rise of modern technology, with its attendant high costs, may even call into question the whole validity of a mass Soviet Army, a cornerstone of doctrine ever since the Revolution. Not only may it be difficult to procure the weapons, but to train two-year conscripts to use and maintain such weapons may not be possible.

The Soviets are already encountering difficulty with the technology currently in service, according to some reports. While the education of the Soviet soldier has increased arithmetically, the complexity of many of his weapons has increased geometrically. Throughout the twentieth century, the pool of skilled individuals in all fields has never been equal to the growing demands of Soviet society, and even though the military has always had first claim on many of these people, they have never had enough. It may be that today's training methods of reducing tasks to single-skill jobs learned through drills and memorisation will prove inadequate to the demands of tomorrow's weapons. As they usually do, the Soviets have attempted a multi-track solution to a complex problem. Lower-readiness divisions will continue to use less sophisticated equipment that requires less maintenance. New maintenance and recovery vehicles such as the MTP and BREM provide additional "repair forward" capability. The proliferation of weapons and systems in tactical sub-units provides redundancy.

Each level of unit, from company to GTVD, has a technical officer or deputy commander for armament functions. He is responsible for the administration and supervision of maintenance and recovery in his unit, and at regiment and higher level is assisted by a staff responsible for different types of weapon (e.g., the division's tank directorate).

responsibility of its driver-mechanic, while the gunner maintains each crew-served weapon, both of them being assisted by the remainder of the crew. They perform their tasks under the direct supervision of the company or battery technical officer. The "mechanic" part of the job description is largely honorary, as their training does not give them the capability to do more than routine maintenance. As well as suffering the low skill levels of many personnel, Soviet companies and battalions cannot undertake medium repairs, and even some routine repairs have to be performed at regimental level. Centralisation is a feature of the Soviet maintenance and recovery system.

Each battalion supply and maintenance platoon includes specialised workshop trucks and trained mechanics and is capable of routine repairs and recovery tasks. Regimental maintenance and repair companies can perform all routine and some medium repairs – those involving major overhaul of at least two basic assemblies – and form recovery and evacuation groups in action. Divisional maintenance battalions are more specialised, with different workshops and more technicians. Major overhauls and complete disassembly of weapons or vehicles are only possible at army and front level, although regiments and divisions can overhaul transmissions and engines.

The recovery and evacuation of vehicles and weapons during battle is the responsibility of battalion, regimental and divisional repair and evacuation groups (REG), directed by the technical observation post (TOP) of each battalion. In combat each battalion splits its maintenance and supply platoon into a TOP and a REG. The battalion TOP is commanded by the battalion technical officer (deputy commander for technical affairs, to use his full title), and includes the three company technical officers, one NBC sensor reader and two mechanics. The remainder is organised into the REG, and is supplemented by regimental and divisional assets. REGs make heavy use of specialised recovery vehicles, such as the T-55-T and T-62-T (M-1977), as well as all the vehicles normally found in the maintenance and supply platoon.

In action the TOP is established where it can overwatch the battalion, while the REG remains further back until ordered forward when the TOP spots a vehicle or weapon that has been hit. In combat the crew will first inspect the damage. If they cannot repair it in 10–15min they will wait for elements of a REG to help them repair or evacuate the vehicle. If the vehicle or weapon cannot be repaired in 30–60min in action or in five hours while on the march, it is neither repaired on the spot nor evacuated to a rear position. Instead it is left for a higher-level unit to collect and tow to a damaged equipment collection point. A divisional collection point will be established by the maintenance battalion about 15km behind the front lines, where it will be co-located with the repair shops. Many of the Arab tanks captured in 1973 had been damaged or had broken down and had been left for rear-echelon REGs to recover or repair. Unfortunately the Israelis arrived first.

The shortcomings of the Soviet maintenance system lie in its centralisation, lack of skilled personnel and orientation towards mobile combat. Centralisation often leads to significant shortfalls in replacement parts, or stock levels that reflect plans rather than needs. Even divisions have only a limited maintenance capability, and it would be difficult to send weapons back to army or front-level workshops for repair and then return them to their units. Thus anything that cannot be repaired quickly and easily is simply left and collected later. Repair assets are deployed forward, obviating the need for rearward evacuation.

Soviet divisions are configured for rapid rebuilding and can use a variety of replacement approaches, adding sub-units, units or low-strength divisions. The concept of replacing whole used-up divisions, one of the pillars of the original nuclear war-fighting philosophy, is not longer central to Soviet plans. The number of repairable vehicles is likely to overwhelm the TOPs and REGs rather easily, and even quickly repairable vehicles or weapons may have to be abandoned. However, the Soviets realise that under mobile conditions it will often not be practical to bring vehicles or weapons back for repair or maintenance, so the repair or maintenance facilities must go forward. The concept of forward repair and Soviet numerical superiority should, theoretically, provide the impetus for the offensive to succeed.

Medical support

Soviet medical support is similar to that in Western armies. It is under control of the Medical Service, but subordinate to the Chief of the Rear at each level.

Individual companies do not have specialised aid men, except for the rifle-armed company first-aid instructor, who supervises the efforts of the soldiers and administers aid when required. The first medical treatment is the battalion post, which includes a *feldsherr*, literally a barber-surgeon but actually a *praporshchik* (warrant officer) with skills between those of a nurse and a doctor. Wounded are evacuated there in battalion vehicles. The regimental medical post, 6–10km behind the front, performs emergency surgery and classifies casualties for subsequent evacuation. It includes three doctors and supporting personnel. Major surgery is performed at divisional field hospitals, while army field hospitals provide specialised surgical facilities and convalescent units for those expected to return to duty in 15–30 days. Front medical facilities are similar and include convalescents out of action for six weeks to eight months.

The quality of Soviet military health care has been uneven in the 1970s and 1980s. While the provision of larger numbers of casevac helicopters and better supply flow has improved the chances of casualties, the health of the army is not good. In Afghanistan, outbreaks of hepatitis have caused many casualties, and similar outbreaks have been reported in the Soviet Union. The problem of infectious disease in the Soviet Army is such that "Extraordinary Anti-Epidemic Commissions" were established in 1984.

In Afghanistan up to 20–30% of a unit may have hepatitis at any time. Hepatitis rates in the army as a whole are reported to have increased 700% from 1978 to 1983 as a result. The drug-use problem in Afghanistan, where drugs are plentiful and cheap and alcohol hard to obtain, is extensive. Soldiers will even sell weapons and ammunition for drugs.

Manpower and training

Wars are fought by men, using weapons that are only as effective as the way they are used. The effectiveness of Soviet weapons and tactics is directly dependent on the effectiveness of the Soviet officers and soldiers and the way they command and are commanded. We can easily measure the effectiveness of Soviet weapons, but the men behind them are the "X" in the equation of victory.

Soviet enlisted men are conscripted for two years, with the exception of naval personnel who serve for three. There are two annual call-ups, May Day and November 7. The military commissariats in each town and district – Communist Party organisations – act as draft boards. Each has a quota of draftees to be supplied to each of the five services and to the KGB and MVD. Each of these has a quota for a different military district or Group of Forces, the Soviets having kept up the old Tsarist practice of trying to send recruits as far as possible from their home districts.

After processing at local level, the conscript is transported to his unit, where he spends a 30-day training period before he takes the soldier's oath. He may then go on for specialist training in his unit or a training division, or take his place in the ranks. The time-expired men leave the unit when their replacements in the new crop of conscripts have reached this stage, although the Soviets may retain them if required. One of the indications of impending Soviet action in Europe would be the retention of one of the six-monthly groups of time-expired men, who would not return home but would remain with their units in East Germany. Once discharged from active service, enlisted men remain in the reserves until the age of 50 (the conscript is normally inducted at 18 and discharged at 20).

Reservists are subject to periodic refresher training. This includes four 90-day periods up to the age of 35, two 60-day periods when aged 36-45, and one 30-day period when aged 46-50, a far cry from the annual training of US reservists. Reserve officers train more frequently, however, with annual active-duty tours up to the age of 35, followed by one every three years to the age of 50.

The effectiveness of this training is uncertain, and varies with category and area. However, the Soviet troops that invaded Afghanistan in 1979 were largely reservists from the Turkestan Military District, which is not a high-readiness area, and they seem to have performed better than those (mainly older men) recalled for the 1968 Czechoslovakia invasion.

Though 1979–80 reservists certainly suffered from a low level of tactical and technical competence, they did get the job done. And while they suffered a number of painful battlefield defeats, the number of defections and desertions was limited. The mobilisation of the western military districts against Poland in 1980–81 revealed further problems, however. Unlike some NATO countries,

the Soviets seldom exercise full-scale call-outs and reinforcement of active units by reservists. Having analysed the problems of 1968, 1977 and 1980–81, they are working to improve the system, though the sheer size of the reserve force limits what can be done. Reserves exercised and trained like their best Anglo-American counterparts would probably be unaffordable, even for the Soviets.

Although the Soviets maintain few purely reserve units like the US National Guard or the British Territorial Army – those that do exist are generally construction or transportation units, normally part of the civil economy but subject to mass call-up – reserves are important to fill out Category II and III divisions and mobilisation-only divisions, to replace losses and handle logistics.

While reserve personnel lack extensive refresher training both as individuals and within units, the Soviets hope that they will prove as adequate as the raw levies that made up much of their enlisted manpower in 1941–45. It is likely that in the future Soviet demographic problems will result in greater emphasis on the use of reserves. Forced reliance on reserves has also been one of the factors behind the drive for design consistency in successive generations of weapons. Thus a tank mechanic who served on T-72s in a western military district will, on mobilisation in his division near home in the central USSR, find that the T-54/55 tanks used there will have a similar engine. The need for simple weapons for reservists may continue to make "high-low" mixes of weaponry essential.

Despite there being every incentive to stay in the service – security, promotion, prestige – the re-enlistment rate amongst soldiers completing their two years is 1–2%, a total of 5% of the Soviet Army being long-service non-commissioned men. Most NCOs are conscripts with little more training than the men they must lead. The increasing complexity of modern weapons and warfare obviously requires greater continuity and experience in the non-commissioned ranks, and to this end the Soviets introduced the rank of *praporshchik* (equivalent to Anglo-American warrant officers) in 1971. Originally it was thought that all extended-service enlisted men would become *praporshchiki*, but this proved impractical and many extended-service men without the qualifications remain as NCOs. *Praporshchiki* are trained in one-year courses and enjoy many of the privileges of officers. It appears that their introduction has been a success. They free officers from many administrative and training tasks, fill many officers' billets, and supervise and direct the NCOs in training the men. Even though they have only recently been introduced, the *praporshchiki* have developed much of the aura of respect and competence of the Anglo-American warrant officer: the wise old soldier, capable of using any weapon or performing any task. Many helicopter pilots are *praporshchiki*. The rank of senior warrant officer was established in 1981 for those with more than five years' service.

Soviet officers enter service by various means. More than a hundred specialised military schools grant a bachelor's degree and a lieutenant's commission after a four-year course. Military training offered through colleges is another source, especially for the reserves. Enlisted men with the required educational background are encouraged to extend their service and try for a commission from the ranks. Officers serve a minimum of three years. The time spent in the reserve is dependent on rank at time of discharge, ranging from the age of 55 for lieutenants to life in the case of marshals.

The rank structure into which these men fit is similar to those of most Western armies, progressing through private, private first class, junior sergeant, sergeant, senior sergeant, master sergeant, warrant officer (ensign) and senior warrant officer. Commissioned ranks include junior lieutenant, lieutenant, senior lieutenant, captain, major, lieutenant-colonel, colonel, major-general, lieutenant-general, colonel-general, army general and Marshal of the Soviet Union.

The level of command responsibility is also similar to those of Western armies, although the Soviets retain their wartime practice of using officers to command formations that their rank would not normally entitle them to command. In the Soviet Army responsibility frequently comes before what Westerners would consider adequate rank. Lieutenants, *praporshchiki* and NCOs often command platoons; senior lieutenants and captains both command companies. Battalion commanders range from captain to lieutenant-colonel, with majors being most common. Regiments are usually commanded by colonels, sometimes by lieutenant-colonels and occasionally by majors. Major-generals and some colonels command divisions.

Training and professional military education

The Soviet Army emphasises training with a zeal that approaches mania. Improving training and its effectiveness is one of the Army's primary peacetime aims. Control of training is centralised, with overall direction coming from the Ministry of Defence and basic planning for training and exercises taking place at regimental level.

The training year normally starts around the beginning of December. It is divided into two periods, winter and summer, with a one-month basic phase before each period. Each period is divided into cycles to cover squad, platoon, company and battalion-level training. Large-unit exercises can be conducted at any time in the period, but usually at its end.

The basic programme normally remains the same for several years at a time. Each type of unit receives the same basic training regardless of location, although there may be additional area-specific training.

Daily and weekly schedules, based on a six-day work week designed to minimise unsupervised time, include combat, political and physical training.

The six-month cycle, in which each unit loses its most experienced men and has them replaced with raw recruits who are not considered effective soldiers for at least six months, has led to many complaints from Soviet officers that they are constantly "re-inventing the wheel." As soon as a unit has worked itself up to some degree of tactical proficiency, both independently and as part of its parent unit, the cycle must begin again, with time and effort being devoted to teaching the recruits basic soldiering rather than polishing tactical skills. The six-month training cycle starts with individual training and works up in a successively larger series of manoeuvres, culminating in twice-yearly large-scale manoeuvres, when whole divisions take to the field.

Despite the introduction of pre-conscription military training when the term of service was reduced from three to two years in 1967, only the Airborne Forces and the Strategic Rocket Forces are entirely composed of soldiers who have received complete pre-conscription military training. The problems of training such a large army by using second-year conscripts to instruct first-year conscripts are vast. Even though today's Soviet soldier is not the often illiterate peasant of the Second World War, the demands of a mass conscript army mean that he requires simple weapons and tactics, much as his father and grandfather did.

A massive service school system exists for officers. Most enlisted training is conducted by the unit in which each man serves his two years. Because of the increasing complexity of modern weaponry, more than half of all conscripts receive three to six months' specialist training. An extensive network of technical schools provides centralised training for many specialists, while all the Army's airborne training is undertaken at the Tula-Ryazan complex. The work of training is carried out by officers rather than NCOs, as in the West, because of the shortage of career NCOs. This is particularly true of technical specialties, in which officers perform functions that would be handled by NCOs in the West.

A number of Soviet tank and motorised rifle divisions serve as training formations in peacetime. They take over some of the training duties of other line divisions, and are responsible for producing NCOs and technicians who then move to another division to complete their service. Since 1984 combat soldiers and NCOs bound for Afghanistan have had three to six months' training in such divisions. Before then, soldiers going to Afghanistan, like those being sent to Group of Soviet Forces Germany, received no special training before joining their units; the paratroopers, who went through their customary schools, were the single exception.

Soviet training is based on drill and memory. Each man has his task and is taught to perform it. The number of men available makes such narrow tasks possible, and the limited time for training precludes formal cross-training, although it is encouraged whenever it does not prejudice other training goals. The widespread use of simulators and older weapons for training in the Soviet Army is possible because of the simplicity of most of the tasks the soldier must perform and of the weapons he uses.

Nevertheless, while training may be drilled into the recruit, it is done under realistic conditions. The Soviet soldier spends much time in the field. NBC training is especially stressed, the troops using full NBC gear and actual chemicals and isotopes being used in exercises. Of course this is dangerous – there are numerous deaths each year and 3% casualties are considered acceptable on exercise – but it can hardly be bettered as a training aid. Physical conditioning is also stressed; the Soviet soldier of today could certainly match the legendary toughness shown by his predecessors in the Second World War. In Afghanistan, however, the physical conditioning of Soviet soldiers, especially reservists, proved to be inadequate to the demands of the opening stages of the war. This has led to an increased emphasis on physical training throughout the Army, but the average fighting soldier remains unlikely to be as fit as his Anglo-American counterpart.

Soviet Army service is tough, even in a society where life itself is often spartan and rough by Western standards, and this accounts in part for the low re-enlistment rate. For example, one air-defence unit near Murmansk had outdoor toilets and no hot water in their "permanent" installation. Motorised rifle units led an even more primitive existence. The Soviet soldier eats a relentlessly monotonous diet; one unit ate unpalatable fried fish every night for two years. He is not likely to see fresh fruit unless his unit grows it in its gardens (which are frequently thriving establishments) or he buys it in the canteen with his tiny salary. Sores, skin ulcers and vitamin deficiencies often result from this diet when the unit is unable to grow its own food to supplement its rations. This has led to many outbreaks of infectious disease throughout the Soviet Army in the 1970s and 1980s. As a result, in the 1980s there was a drive to encourage units to feed themselves through regimental "auxiliary farms," upgraded versions of the traditional garden. However, the time devoted to this, along with gathering in the harvest on state farms, will certainly cut into training.

A conscript normally receives no home leave during his two years, and seldom leaves the base except on duty or on organised "cultural" visits, usually chaperoned by the political officer. His free time is devoted to "voluntary" tasks and activities as well as organised sports.

Men in their first six months of service are expected to do all the fatigues for men in their last six months. Even though most are still privates, these more senior enlisted

men exert more real authority than conscript sergeants with but six months of training behind them. Soviet officers exploit this unofficial chain of command as much as possible, often assigning the senior privates to jobs in the knowledge that they will pick and supervise a number of more junior men.

It is a rigorous term of service, but the emphasis on service to the state throughout Soviet society and the patriotic pride of the average Russian make it a burden that is accepted by the vast majority of the population. Most Soviet men serve in one form or another, except for those unfit or deferred. Conscientious objection is unknown to Soviet law, and will probably result only in a trip to the *Gulag*. The children of long-service NCOs, coming from an environment that is both privileged and brutal, are among the worst of what the Soviets call "hooligans."

Alcoholism is a problem in the Soviet Army. No alcohol is sold on post, resulting in vigorous efforts to obtain it, either by barter or by moonshining. This in turn provokes frequent surprise inspections. While Soviet and Russian officers have a reputation for hard drinking dating back to Tsarist times and reinforced by the Second World War, more than occasional intoxication could imperil a career. Afghanistan has increased the Soviet Army's drug problem. Denied the usual sources of alcohol, the troops turned to the cheap and plentiful drugs that grow in Afghanistan. Rear-echelon troops, having more contact with the locals, are the biggest abusers.

Discipline is tough. The Soviets still shoot soldiers, not only in war zones like Afghanistan but also under peacetime conditions. A dishonourable discharge can blight an entire life. The officers, NCOs, political officers and the KGB all keep an eye on the soldier. Anyone falling out of line is dealt with very quickly. Despite this, AWOLs and desertions are relatively frequent. The naval mutinies of the mid-1970s may have been just the tip of the iceberg. The suicide rate in the Soviet Army is over twice that of the general population. Prejudice is common, and first-year conscripts bear the brunt. Again, the long-service NCOs have been singled out as the worst offenders. Moslems are particularly badly off in those units that substitute pork for fish as the diet staple. Some Soviet units apparently have a rather brutal, prison-like caste system in the barracks, though others are co-operative and tolerant. While the sanctions applied to those who fall foul of this discipline are harsh in the extreme, the rewards of the system – a technician's qualification, leave, "soldier of the month," even a stripe – are coveted none the less.

The Soviet junior officer is exempted from none of the rigours of peacetime training, when, as in combat, he must lead from the front. Thus each platoon commander leads his men in morning callisthenics and shows them all the other tasks they are supposed to master. He must also supervise the training of the unit, and conducts some of it himself along with his NCOs and second-year conscripts. In addition, he must see that all equipment is combat-ready while simultaneously improving his own professional military education. For the attentive and reliable promotion can be fast: three years each as a lieutenant and captain, with a majority and a battalion command before the age of 30 not unknown. Most officers take a three to five-year course at an advanced military academy, a necessity for any officer intending to make the army his career. Entrance is by competitive examination (after suitable checks on political reliability by the KGB), normally after three or six years' service in the field. For the rest of his career the Soviet officer will alternate between field commands, staff positions and increasingly higher levels of professional schooling. The Soviet officer may spend up to 40% of his years in uniform at various schools; in this way the Soviets hope to promote the effectiveness upon which military success depends. There are many speciality, branch and service schools.

Headquarters

All Soviet units of battalion and larger size deploy their headquarters in three parts: a forward command post, a main post and a rear post.

The commanding officer is normally in the forward command post, as close to the front as possible. On the march the forward command post is near the head of the main body, often moving up to the tail of the advance guard when action is expected. It is mounted in a light mobile vehicle, usually a BRDM-2U command scout car, but command versions of tanks, APCs, BMPs, BMDs and jeeps are also used. This allows the commander to take personal control of a developing situation or make decisions on troop movement, which the Soviets consider especially important in the mobile conditions they expect in modern warfare. At division level such a forward CP might consist of as few as three or as many as ten vehicles. In an attack it would follow the first-echelon regiments.

The main command post handles most command functions. It is commanded by the unit chief of staff and at battalion or regiment level is also mounted in a special vehicle, usually a command version of a tank, BMP, BMD or APC. A main divisional CP, consisting of 100 vehicles deployed over up to three square kilometres, is usually located 5–15km behind the FEBA. A main regimental CP, up to 5km from the FEBA, has about 25 vehicles deployed over a 400m² area. At division and higher level the main command post is divided into a main and an alternative main position, separated by a nuclear safe distance. Consisting of about 12 vehicles deployed over about 300m², the alternative CP is three to five kilometres from the main CP. Frequently the alternative command post is only a skeleton, owing to the shortage of staff officers, technicians and communications equipment. Alternative command posts are often co-located with division artillery

group headquarters. In the main command post the chief of staff remains in contact with the forward and rear command posts, handles co-ordination of forces, and generally takes all actions possible to leave the commander in the forward command post free to fight the battle.

The rear command post handles all logistics and service support functions, and is commanded by the unit's chief of the rear, the deputy commander for rear services. Usually co-located with logistic elements, divisional rear CPs are usually 10–30km from the FEBA and consist of about 25 vehicles; regimental rear CPs are 5–20km behind the FEBA and about half the size of their divisional equivalents.

A divisional headquarters consists of a divisional commander and three deputy commanders: first deputy (a peacetime-only appointee who will fill a mobilisation role), deputy commander for political affairs, and deputy commander for the rear (who commands the *tyl*). The last is assisted by the deputy commander for technical matters and the rear staff.

Under the divisional chief of staff are the traditional four staff sections – (1) operations, (2) intelligence, (3) signals, (4) personnel – plus topographic, crytographic and administrative sections. There are also the chiefs of arms and directorates for the different branches of service: rocket and artillery, reconnaissance, signals, air defence, engineers, NBC defence, armament and finance. The section chiefs for all intelligence and signals double as chiefs of the branch directorates. Part of divisional headquarters but not under the divisional commander is the 16–man KGB "00" section, which runs a network of informers throughout the division and keeps a watchful eye on both military and political officers.

Soviet Army operations have featured increased use of airborne command posts. In Afghanistan Mi-8 Hip helicopters and twin-engined Antonov transport aircraft have acted as forward command posts and as "master bombers," directing air strikes, while Il-76 Mainstay AWACS aircraft have directed helicopter strikes. An An-12 Cub airborne command post, used in the 1984 Panjshir VII offensive, was known to the Afghans as "The Flying Kremlin." Il-20 Coot-B airborne command posts could be used in a future conflict. An airborne command post version of the Mi-6 Hook-C helicopter has also been reported.

Soviet battalion headquarters are small by Western standards. Division is the lowest level at which there is a full, dedicated general staff, with directorates for each arm of service (at regiment, sub-unit commanders act as deputy chief of staff for their particular speciality) and a full political directorate. Divisional headquarters, however, like those below them, are concerned with day-to-day action as well as the development of the battle. Army headquarters will plan four or five days in advance, and front and GTVD headquarters are responsible for long-range operational planning.

C-cubed ("Troop control")

C-cubed – command, control and communications – is likely to be the decisive element of a future war in Europe. If the Soviets can maintain adequate levels of C-cubed, their system of operations and tactics and numerical superiority should give them victory. Conversely, NATO relies on its C-cubed to make it possible for the active defence to defeat Soviet thrusts. All the effectiveness of weapons and tactics are futile without C-cubed and another "c", cohesion, which distinguishes a military unit from an armed mob. "Troop control" is the Soviet term.

The men responsible for command and control – Soviet officers – are respected members of society, and those of major rank and above are an elite, with the special shops and other privileges that are accorded by Soviet society to those whose services it values most highly. A Soviet lieutenant receives about 20 times the pay of a private. Officers receive at least 33% more pay than they would receive in civilian life for similar skills and qualifications. With his background of intense classroom study (heavily based on military history), realistic field training and private study the Soviet officer is a skilled professional. But at the same time there are drawbacks that even the Soviets will acknowledge. These include a lack of technical expertise, lack of experience and professionalism (especially in the lower commissioned ranks), and a lack of initiative.

Until the Soviet Army entered Afghanistan in 1979, few of its members had had any combat experience since 1945, and those still in the service were then generals. While the US experience in Vietnam has limited application in a future conflict, it did weed out a fair deal of dead wood amongst the officer corps and gave others (though not always the right ones) the chance for advancement.

This seems to have been the case with the Soviets and Afghanistan. Those generals and marshals most closely associated with the war have thrived. In many cases this was perhaps not necessarily a direct result of their Afghanistan service, since they had probably been seen as being among the most capable officers before their involvement in the war. But their continued progress is evidence that they have not blotted their copybooks. At lower levels of command it is "the man from Afghanistan" who is seen as the "right-flanker", the officer who works for effective training. It is perhaps this attitude towards the general lessons of combat – rather than tactical improvements in helicopter or motorised rifle tactics – that is the most significant effect of Afghanistan on the Soviet Army as a whole.

The Soviets have made thorough attempts to compen-

sate for any lack of experience through realistic training and exercises, intense professional military education, the study of military history – emphasising the lessons of the Second World War – and keeping a watchful eye on worldwide developments. Critiques and evaluations can be rigorous. In wartime Soviet officers who blundered were frequently shot; today their careers just wither away.

Despite all his advantages, however, there are frequent reports that the Soviet officer, especially at lower levels of command, does not know his business. Of course this is not limited to the Soviet Army – the most dangerous thing on earth is a US second lieutenant with a map – but the size of the Soviet Army, and its limited (by Western standards) pool of skilled individuals available as officers, makes the problems worse than elsewhere. The evidence for this ranges from comradely criticism of officers forced to do jobs for inexperienced NCOs at the expense of their own command function, to the sight of two columns of Soviet tanks, lost while on manoeuvres in East Germany, appealing to a nearby US Army observer to read their maps and direct them, which he did. In action the US Army may not be so accommodating. The Soviet system does little to prevent such things. The inadequacy of much technical training is apparent, especially in units using complex equipment, and it is inevitable that the officer is personally required to do much of the work, often because he is the only one who understands it. Maps are secret, and issued to officers only on signed receipt, so familiarity with them is hardly assured.

In the Second World War the Germans considered the Soviet front and army-level commanders to be flexible, energetic and full of initiative, in contrast to the inflexible, indecisive commanders at division and lower level, who, though often technically and tactically competent, grasped the letter of their mission but not the spirit, and thus tended to rely on stereotyped action rather than "bold and decisive manoeuvre." Today the divisional and regimental commanders are far better trained than their wartime counterparts who were survivors of the purges and who had to learn their task in battle rather than in the classrooms and manoeuvres of today. It is also doubtful whether the front or army commanders are any less skilful than the men who gained victory in 1944–45. Whatever criticism the Soviets have against men at this level, it does not often appear in available literature, adding to the existing sense of competence. The Soviet emphasis on the operational level of war maximises the strengths of the less numerous higher-level commanders while minimising the weaknesses of those at lower levels. But even at the higher levels the centralised nature of the Soviet Army means that all these commanders are implementers rather than planners (who are the Chiefs of Staff).

The Soviet system of C-cubed is designed to minimise the effect of individual officers. Sub-units are expected simply to carry out orders, and the system by which these orders are to be carried out is as straightforward as possible. Problems will arise when the situation does not admit of straightforward solutions, such as when a unit is performing as an advance guard, forward detachment or outflanking force, or whenever independent action is required from a sub-unit commander. Such problems have certainly been widespread throughout the war in Afghanistan when sub-units have been required to act independently; effective independent battalion operations were not seen there until after three or four years of war. The Soviets appear to have appreciated this situation, and the sub-units designated for these missions have the most experienced and highly skilled commanders.

The lower they are in the chain of command, the less experienced are the commanders. The squad leaders have no more experience than their men, and have no other NCOs to assist them. This is despite the greater loads placed upon sub-unit commanders by the greater emphasis on manoeuvre, surprise and exploitation. The Soviet way of life, the simple, drilled tactics, the repetitive single-task training and the de-emphasis on communications have all contributed to what probably amounts to a weakness in sub-unit command. Whether this weakness is enough to cancel out the advantages elsewhere in the Soviet system is uncertain. It has also been suggested that bureaucratisation, buck-passing and careerism – stressing self-advancement at any cost and avoiding blame for whatever goes wrong – have a deep hold on Soviet officers. While these elements are present in any army, the Soviets may well rely on them more than others to keep at least the illusion of cohesion.

The Soviet emphasis on pre-arranged planning in place of radio communications reduces both tactical flexibility and dependence on the radio. Jamming and nuclear blasts may turn the airwaves into masses of static; radio direction-finders will call artillery on to active emitters. The US Army has found what can happen when its units, which depend heavily on radios for their C-cubed, are suddenly deprived of them: things suddenly revert to 1916-style chaos. The Soviets believe that an army should train the way it will fight, and they try to minimise the use of radios, although the links between artillery COPs and battalions and each unit's three-part headquarters are especially important and vulnerable. However, they minimise this vulnerability by using couriers and landlines whenever possible and enforcing strict radio discipline. Soviet society teaches you to keep your mouth shut, if nothing else.

These limitations apply not only to sub-unit commanders, but also to junior officers on unit staffs. The Soviet press has criticised the "level of staff culture", especially at regimental and divisional level, where the plans for the sub-units are drafted. There have been complaints that the staff officers at these levels do not know their business; this is especially important as these are the

levels of command that must make the hour-to-hour decisions in mobile combat. Soviet centralisation of command normally results in over-supervision, but compounding it by weakness in the centralised authority cancels out many of the advantages that might otherwise compensate for it.

Initiative is a key factor in the effectiveness of the Soviet Army. Western sources constantly debate the quality of initiative among Soviet commanders. The Soviets have their own debates as well. The demands for initiative as a component of leadership come down from above as often as lamentations of its absence. When he was Minister of Defence the late Andrei Grechko said: "Without initiative, it is impossible to achieve victory," regardless of the soundness of doctrine and armament norms. Similarly, the late Marshal of the Soviet Union V.D. Sokolovskiy exhorted: "Generals and officers of the Soviet armed forces are not mechanical executors of the plans of their seniors."

It is wrong to picture a Soviet officer at any grade, and especially at regimental level and higher, as an automaton, the product of centuries of traditional subservience to the group and burdened by the centralisation of command and other baggage of Marxist-Leninist doctrine. Yet he is still less independent than his Anglo-American counterpart. The emphasis on complete obedience to orders and the tendency to centralise decision-making and to look to the word from above are inherent in Soviet society.

This is especially evident in the conduct of enlisted men and junior NCOs, whose low pay, poor conditions of service and minimal motivation lead to a tendency to "hide behind their comrades" and do the minimum possible while serving their time – hardly an unusual attitude for conscript soldiers anywhere in the world. The disparity between Eastern and Western personnel is greatest at NCO level – long-service professionals as opposed to short-service conscripts – and in sub-unit command. In any army the amount of permissible and even desired initiative decreases at lower levels of command. Originality is much more valuable amongst generals than second lieutenants. The Soviet company commander, for all the power he commands, is there simply to carry out evolutions as part of a battalion which fights as part of a regiment. This is a far cry from the role of the commander of a British Army company combat team, who is expected to perform independent operations under "mission" type orders, as opposed to the detailed instructions prepared at regiment or division for Soviet company commanders. The same is true of battalion commanders. But the higher the level, the more the Soviet commanders will be limited only by their own knowledge and imagination. The Soviets will have to pay a price if they ever fight with their current command system. They will pay it in opportunities missed, in units defeated, in heavy losses. Yet if doctrine is effective, armament norms are met, combat efficiency is achieved, and the system does not collapse or falter in the pressure of combat so intense as to make the worst days of the Second World War seem easy, it may be that the price, though high, is reasonable if it brings victory.

A unit's performance in battle is probably determined more by its cohesion than by any other factor. When studying hardware and tactics it is easy to forget that a unit is not just a collection of "human resources" and weapons. It is an entity, a living thing, with its own rituals, shared values, purposes and sense of belonging, the same as any tribe, gang or other primary group. It is the strength of the primary group bond that creates cohesion, whether in the palaeolithic hunting party or an ATGM crew.

Effective leadership is probably the single most important element in creating a cohesive military unit. The shared hardship, risk and suffering produce a bond of loyalty between the led and the leader, who must use this loyalty to lead his group to accomplish its mission as a military unit. The leader must prevent his group from dissolving into a collection of scared individuals, using direct personal leadership to reinforce the group's sense of unity, while simultaneously providing a direct personal example of action under fire as he leads the unit through its mission. Without such leadership, all the weaponry and training in the world cannot yield combat effectiveness.

The Soviets have attempted to build cohesion into their tactical system, minimising the need to provide it directly; this is much as they have attempted to do with sub-unit leadership. They also rely on ideology as a motivating force. Supposedly, the "new socialist man" has no need of group attachment or loyalty to a commander to fight his best. The Soviet Union is a total state. The state is the only institution that is capable of receiving loyalty; not the family, not the church, not even the military unit. While the Soviets try hard to instil pride in units and sub-units through "socialist competition" and teaching history and tradition, Marxism-Leninism perceives a cohesive military unit as "a microcollective without socially significant values". Personal attachment to the group, not ideology, is the key to cohesion. Experience and studies have shown that, except in rare instances, ideology is of little concern to men in foxholes.

Though the Soviet soldier may be surprisingly aware of prevailing conditions inside his country, no one need doubt his patriotism. But it remains that men fight so as not to disgrace themselves in front of the group. Leadership is more than a matter of applying scientific principles in a planned manner, as a first glance at doctrine might lead one to think it is. The Soviets know the leader is important, and stress his role. But despite the tremendous Soviet concern with training, they are little concerned with cohesion, which is a very different thing. The US soldier of the Vietnam War was well trained, yet his cohesion was poor. It would be an exaggeration to say that the primary group bond is unknown in the Soviet Army, but the

systems of leadership and command do not use its full potential.

Examples abound of how Soviet tactics have been optimised to be effective despite C-cubed deficiencies. Riflemen will not fire in combat unless they are part of a group that is firing or under the eye of their officers and NCOs. Only 15% of the US Army's riflemen of the Second World War used their weapons in combat, even though they were amongst the best trained in the world. The Soviets cannot help but be aware of this problem. In an APC or BMP the riflemen are in close contact and under the eye of their commander, although he also has to command the APC. The assault rifle-armed soldiers are more inclined to spray their ammunition instead of not firing, hoping to suppress rather than to hit. Soviet dismounted skirmish lines, combined with the oft-repeated need to keep the attack moving, are basically 1916-style attack formations: simple, maintaining direction, but relying on suppressive fire from supporting tanks, APCs or BMPs to prevent enemy weapons from decimating them. This approach is dictated by the limited Soviet C-cubed capability.

The whole concept of the Soviet high-speed armoured offensive is as much a solution to a C-cubed problem as to a tactical one. Dismounted infantry can be pinned down by machine guns and artillery and separated from their tanks, making both vulnerable. In the Second World War the Soviet answer was to mount infantry on the backs of tanks, thereby ensuring that the infantry would be able to stay with the tanks, would not lose its direction, and that the lack of trained NCOs and officers would not show. They only had to hang on until the dismount point was reached. It also prevented the infantry from being pinned down, and it is difficult, physically and psychologically, to abandon a moving vehicle. The widespread use of the APC and BMP – there is no Soviet foot infantry – allows the most effective use of a large force of short-service conscripts with a severe lack of skilled NCOs and junior officers. The men have only to stay in their vehicle and fire, so that C-cubed is much easier in a mounted infantry force than a dismounted one.

Other threats to Soviet unit cohesion are language and nationality differences. Unlike the practice in the Second World War, units have no regional or ethnic affiliation, and an effort seems to be made to achieve a distribution of ethnic groups in each unit. However, technical jobs attract a preponderance of Slavs, while Asians seem to be heavily represented in construction units. Category II and III divisions will however take on an ethnic character on mobilisation as whenever possible they will draw reservists from the area in which they are stationed to bring them up to strength. The first Soviet units to invade Afghanistan had large numbers of Asian troops because the divisions were low-readiness formations brought up to strength with reservists from military districts on the Afghan border.

Up to 25% of the Soviet Army's soldiers do not speak fluent Russian, the language of all commands and instruction. After conscription was reduced to two years in 1967, formal Russian-language instruction was removed from Army training and non-Russian-speakers had to turn to their comrades in barracks for help. By the 1980s, however, Army-issue Russian-language textbooks had started to reappear. A long-term solution to the problems posed to a Russian-dominated structure by linguistic and ethnic non-Russians will certainly become more of a necessity in years to come.

A language barrier can disrupt unit cohesion, as shown by the Austro-Hungarian Army of the First World War and the US Army of the Korean War, when up to a third of the riflemen in many units were Korean recruits. This is also another reason for the Soviet insistence on memorised, lockstep drills for training and on the battlefield. It is hard to be innovative about C-cubed when a quarter of your force cannot understand your language.

The dysfunctional elements of Soviet society cannot help but be present in an Army drawn from the broad base of the population. Everything that gives daily life its own inimitable surrealistic quality persists, despite the constant striving for military efficiency. Shortages, low-quality material (with the exception of most weapons) and a reliance on centralised authority reduce motivation and give a soldier little reason to act except to follow orders, meet quotas and do whatever he has to do without rocking the boat. For example, the effectiveness of ammunition handlers is measured by the number of trucks they can load in an hour. It is easy to load the trucks so that they appear full but have only 70% of the ammunition they are supposed to be carrying. While it is unlikely that this would occur in wartime, it means that the ammunition would not be moved as quickly as the Soviets believe.

For all the improvements of recent years, the degree of technical expertise in the Soviet population is still below that of the US and Western Europe. In those countries people grow up from the cradle surrounded by machines which are alien to the Soviet Union where consumer goods are perennially in short supply.

While Soviet weapons have always been among the best in the world, their other equipment is a mixed bag. Privates and NCOs are still issued with the traditional foot cloths instead of socks. Soviet uniforms have evolved in the 1970s and 80s and are now closer in quality and usefulness to those in the West. Most Soviet kit items tend to be heavy and often inefficient. But quality can be acceptable – the Afghan Resistance has no problem with using captured Soviet jerricans. Field rations were improved after large numbers of troops went hungry in Czechoslovakia in 1968, but they are still not as good as comparable US or British ration systems. Soviet officers receive special ration packs, which can alternatively be used to feed three privates.

Throughout Soviet society, anyone who wants anything

knows that there are friends to be asked, palms to be greased, favours to be exchanged. It is only to be expected that vehicle inspectors are bribed, or that soldiers on manoeuvres gladly swap their rubberised NBC suits with fishermen in exchange for fresh fish. One tank crew in Czechoslovakia in 1986 sold their vehicle to a scrap dealer for a crate of vodka. But the Soviet soldier will not normally barter weapons or ammunition. That is a political crime, not a "criminal" one, and could be punished by death. In Afghanistan, however, Moslem soldiers sympathising with the Resistance – a small but significant percentage – and drug addicts in need will frequently take risks and give out weapons and ammunition.

The use of soldiers for "volunteer" labour on the harvest and other civilian projects is widespread – Group of Soviet Forces Germany regularly sends back men to work the land – but is a waste of training time. Soldiers used to help with the harvest are tremendously inefficient. Without incentive or motivation, they eat, barter or simply lose through sheer negligence huge quantities of food. Trotsky said that "old vagabond Russia" was the weakness of the Red Army. That is probably still true today.

The political officer

Every Soviet unit has its deputy commander for political affairs, responsible to the Main Political Administration of the Armed Forces, an agency of the Central Committee of the Communist Party of the Soviet Union. The provision of political officers at every level down to company provides political control and tries to make good the slogan that "the Army and the Party are one." They are party functionaries first, rather than military officers. Their duties include creating proper support for the Party, which includes moral and political training (a big part of the Soviet soldier's service), and organising Komsomol and Communist groups in each unit. The political officer's presence, plus the near-universality of military service, makes the Army a superb instrument of indoctrination.

For all his totalitarian implications, the political officer of today is a far cry from the bungling commissar of 1941. Although he no longer has command responsibilities, the political officer still plays an important role, especially in sub-units, where he contributes greatly to cohesion, efficiency and training. He still continues his political and moral training classes, even though today's Soviet soldier is often much more knowledgeable about conditions at home than he is about world events. The main reaction to the political officer's hyperbole is boredom (except when films, usually inspirational wartime efforts, are shown) rather than disrespect. The company political officer is one of the most well respected men in the Soviet Army. Even amongst recent emigrants, who hold no love for the Soviet system, very few would say anything bad about their sub-unit political officer. His duties are not limited to political instruction. As they include maintaining morale, the political officer also performs other classroom training and is primarily responsible for sports and whatever recreation the Soviet soldier receives. It is usually the political officer who organises and conducts off-post tours, even giving up his free time to do so. He also functions as a combined personnel officer and chaplain, and while his efforts on behalf of the soldiers are not always spectacular – obtaining home leave for someone with family trouble, for example – he is always appreciated by the unit.

The political officer also has military functions. In addition to his political training, he is also a qualified officer in the branch of service to which he is assigned. He is, like the commander, responsible for all that happens in the chain of command under them. This is the Soviet concept of "the vertical stroke". While this makes the Soviets wary indeed about granting subordinate commanders any discretion or independent authority, and makes the covering up of incidents and shortfalls practically a necessity, it transforms commander and political officer from adversaries to partners.

An artillery battery political officer is capable of performing the duties of an artillery officer. He often acts as a direct assistant to the sub-unit commander, taking on some of his paperwork or, in action, bringing forward supplies or reorganising a battered company. In the Second World War the political officer often provided an example of personal courage to the troops. He is usually a bright, aggressive young man, often on his way upwards.

The late Brezhnev era apparently saw a greater tendency towards "ticket punching" by political officers. Some apparently hoped to advance themselves by overshadowing their unit or sub-unit commanders, others by trying to present the best, if not necessarily an accurate, picture of their activities to their superiors. They were thus certainly not immune from the problems besetting the Army and Soviet society as a whole in the late 1970s and early 1980s.

The political officer is a powerful force for C-cubed and cohesion in the Soviet Army. In actuality, if not on paper, he wields great power and can influence the actions taken by his commander in war and peace. He brings the word (and eye) of the Party down to company level. Despite all his other duties, the political officer remains primarily that – political.

Chapter Eight

Tanks

"Only armour can assure the rapid and total destruction of the enemy. It alone can achieve swift and decisive victory under modern conditions. Armour is the basic manoeuvre element of the Soviet Army – it plays the decisive role in the attack."

MARSHAL OF TANK FORCES P.A. ROTMISTROV

Soviet tactics are tank tactics. The Soviet Army depends more on the main battle tank than on any other type of weapon system. If the main battle tank ever stops being a valid weapon, then the Soviets are going to have to get a whole new army, because the present one will not work any more. The tank is an integral part of the Soviet way of war, and it cannot be divorced from it or considered in isolation. The Soviet Army is an offensive force, and the tank is the weapon with which high-speed offensive war is waged. The 53–55,000 front-line tanks in service in the mid-1980s (plus 9,000 or more in war reserve stocks) are to the Soviet Army what the ship of the line was to Nelson's navy: the most important weapon, the key variable in the equation of victory. But the Soviets realise that tanks can only achieve victory as part of a combined-arms force, and that tanks need the other arms as much as they need tanks.

The tank is the ideal weapon for the high-speed offensive because the increased lethality of modern weaponry has put a greater emphasis on manoeuvre. Tank armies, divisions and regiments are intended to attack an enemy on the move or a defending enemy neutralised by conventional or NBC weapons, or to exploit success. Their mission is to outflank, envelop and pursue, defeating the enemy through manoeuvre rather than by frontal attack.

The largest Soviet tank unit is the tank army. A mobile, powerful exploitation force, it penetrates gaps in the enemy defences, plunging deep into his rear areas. The tank army is the front's strategic, offensive, exploitation force. Any commitment is expected to yield decisive results. Normally positioned in the front's second echelon, the tank army is not committed until there is a gap at least 20km wide and 40km deep. Once committed, the tank army keeps pressing on towards the front's objective, bypassing resistance, encircling and pursuing enemy units but leaving their containment or destruction to follow-up forces. The Soviets believe that the speed and shock of the advance is the best defence against enemy counter-attacks, although a typical tank army with three or four tank divisions will have a motorised rifle division in its second echelon to help secure objectives. The tank army is logistically capable of advancing 320–520km after commitment, depending upon terrain and resistance, an advance that the Soviets believe should bring victory.

Although it is not a breakthrough "steamroller" force, the tank army will be used in the first echelon of a front attack in good tank country if the enemy is weak, off balance or can be encircled or defeated by quick offensive action, or if the attack is to be preceded by NBC or conventional strikes powerful enough to destroy most of the enemy's defensive power. These criteria hold for first-echelon commitment of tank units down to regimental level. The motorised rifle units will make the breakthrough, if required, and the tanks will then exploit and pursue.

The tank army is not a defensive force. If the front is forced on the defensive, the tank army will usually not be given a sector to hold and it will be used as the main striking power of the front's counter-offensive. Any enemy thrust that penetrates the Soviet defences will be counter-attacked in a mobile, meeting-engagement battle by the tank army. If the defenders halt the enemy, the tank army will immediately pass through them and use the enemy's temporary imbalance to resume the offensive.

The tank division is the primary offensive manoeuvre force of the Soviet Army. Used as an exploitation force and normally in the second echelon of combined-arms armies, it is also the primary component of the tank army. Like the tank army, the tank division creates and maintains shock action in the enemy rear, defeating any counter-attacks in a series of meeting engagements. Again like the tank army, it can also be used in the first attacking echelon if conditions are right.

In the march to contact, the tank division will normally have the two tank regiments of its first echelon advancing abreast, each in one or two columns, following the

Left: T-72M1 with 12 smoke mortars, fabric armour skirts and attachment points for a mine plough crosses an engineer bridge.

divisional and regimental reconnaissance patrols. Their march order is intended to allow a rapid attack from the march in regimental strength. The tank division follows standard Soviet tactics, with strong pockets of resistance being left to motorised rifle units. Pursuit is envisaged as an important role of the tank division. Wartime mobile groups, which were inserted through penetrations in the enemy front lines for mobile battle behind them, were often organised around armoured corps. The tank division, as successor to the armoured corps, will probably make up the basis of operational manoeuvre groups (OMGs), successors to the mobile groups.

Tank forces are suitable for the exploitation role at both operational and tactical level. While OMGs certainly have an exploitation role, they are not limited to it. Front or army-level OMGs can be based on tank divisions, especially those with the new corps-style organisation. The tactical "keys that unlock the stability of the defence" such as *reydy* or forward detachments will often be tank units. The tank regiment has evolved from an all-tank force in the 1970s to a miniature division which is capable of carrying out independent army-level missions.

Tank divisions on the defensive will not usually hold a sector if they can be replaced by motorised rifle divisions, allowing the tank division to be used as a counter-attack force. However, tank divisions may be positioned in the army first defensive echelon in good tank country or where a strong enemy armoured thrust is expected. Defending tank divisions form the standard Soviet pattern, with security elements, two echelons and a reserve.

The tank division has a large logistic requirement. A day's approach march can use up each tank's fuel. A few hours of sustained action can expend its 40 rounds. Despite important and substantial improvements in Soviet logistic capability, it is still a weakness and may become especially evident in the type of fast-moving, intense continuous combat in which the tank division is intended to engage. The Soviet concept of continuous combat may impose demands far above anything ever seen in previous conflicts, even the 1973 War. Tank divisions already have a high maintenance requirement, and these operations will lead to their burning out and having to be replaced with other units. However, the Soviets believe that a tank division should be capable, logistically and in combat power, of five to six days of sustained operations.

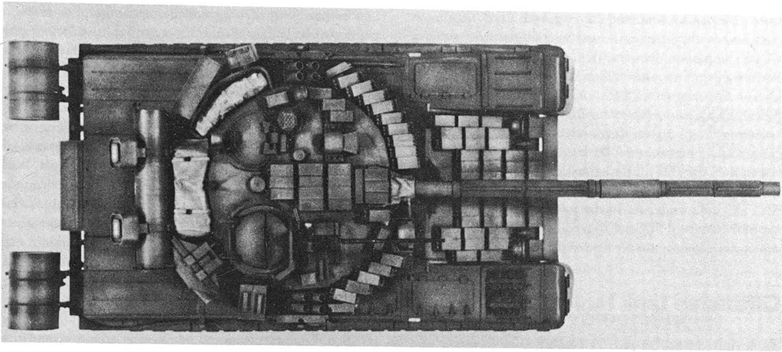
The tank regiment is employed in much the same way as the larger tank units. In motorised rifle divisions it is normally deployed as an integral unit in the divisional second echelon, along with the BMP regiment. Direct support of motorised rifle sub-units is left to the tank battalions of motorised rifle regiments. Along with the independent tank battalion, the tank regiment is also used in the exploitation role, and its component units make up forward detachments and *reydy*. On the defensive, in addition to the counter-attack role, the tank regiment may detach units to hold the security zone. Tank divisions usually have two tank regiments as their first echelon.

In the 1970s the tank regiment was transformed into a combined-arms tactical force. In addition to its combat support companies, the regiment received first a BMP-equipped motorised rifle company, then a full battalion. A tube SP artillery battalion and, probably, a multiple rocket launcher battery were also added. Of course, like all Soviet organisation and equipment changes, these additions were implemented slowly and not necessarily throughout the army.

Tank regiments had no organic regimental artillery until the mid-1970s, and it is probable that some lower-readiness tank regiments still did not have their artillery battalions in the mid-1980s. Regimental MRL batteries were originally manned only on mobilisation. In the future they may also be manned in peacetime. Although tank units practise indirect fire, divisional guns are usually attached for artillery support. A motorised rifle battalion is organic to each tank regiment in a tank division. This apparently also dates from the mid-1970s, although a decade later it is uncertain whether all tank regiments have these BMP-equipped battalions. If tank regiments in a tank division require additional motorised rifle support, the two first-echelon regiments will each have a battalion from the division's motorised rifle regiment attached.

Tank battalions in tank regiments have 31 tanks. Those in motorised rifle regiments have 40, as do the independent tank battalions in some motorised rifle divisions (the latter have also been reported as having 51). There have been proposals to increase the long-range firepower of battalions by adding a platoon of four AT-8-armed tanks or gun-armed tank destroyers; there is however no evidence that this has taken place. There are repeated but unconfirmed reports that tank battalions in Group of Soviet Forces Germany will have four tank companies on mobilisation. There are also specialised tank battalions, such as those in Naval Infantry brigades. The 31-tank independent heavy tank battalions, with their JS-series and T-10 tanks, were probably phased out in the 1970s, although it is possible that some of them may now be mobilisation-only formations. Each type of battalion has a different mission. The tank regiment's battalions are the weapon of decision in manoeuvre and exploitation. The motorised rifle regiment's battalion provides direct support, and the independent tank battalion exploits and forms forward detachments or *reydy*, often working in conjunction with BMP-equipped sub-units.

The tactics of the tank battalions of tank regiments follow the basic pattern of larger tank units. Two battalions usually comprise the regimental first echelon in the attack, and one reinforced battalion serves as the advance guard in the march to contact. Battalions, unlike regiments, will often attack with all three sub-units



Top of a T-80, showing how the reactive armour is positioned.

abreast, the attached BMP platoon following each company. A tank platoon, frequently co-located with the battalion commander, is often positioned in reserve behind the attacking echelons to meet unforeseen circumstances or to shift the thrust of the operation. A tank attack against a strong position may be delivered in three company-sized echelons, the first echelon having the heaviest motorised rifle support.

In defence, tank battalions will adopt a standard interlocking strongpoint defence, or can be used to form anti-tank strongpoints or anti-tank ambushes to strengthen other units. A division will usually keep a reinforced tank battalion (positioned behind the second echelon) as its reserve and counterattack force.

Motorised rifle regiment tank battalions are used for direct support of the motorised rifle sub-units and rarely fight as whole battalions. A 13-tank company is normally attached to each of the regiment's three motorised rifle battalions, and a four-tank platoon is in turn attached to each of the battalion's three companies, giving combined-arms integration down to company level. The tank battalion and company HQs are normally co-located with the motorised rifle regiment and battalion HQs respectively. The tank units are under command of the motorised rifle sub-unit commanders, but the tank battalion commander can use the battalion radio network to redistribute or mass his tanks. If a regiment is attacking in two echelons, tanks will sometimes be stripped away from the second-echelon units to help lead the assault. Occasionally, the battalion will be massed and will fight in the second echelon. In the defence, one tank platoon is positioned in each motorised rifle company strongpoint. The Naval Infantry tank battalions have basically the same mission as motorised rifle regiment tank battalions.

Tank companies normally operate as part of the tank battalion, except for tactical missions such as forming the battalion advance guard, acting as an enveloping or outflanking force, or acting as a forward detachment or *reydy*. Tank companies themselves fight as complete units, with all the tanks and any attached AFVs within sight of the company commander's tank. Companies acting independently, however, may detach platoons to serve as combat reconnaissance patrols and to act as a base of fire or an outflanking force in action. In each tank company on the move, one platoon will be designated to engage helicopters with machine guns or main armament, each tank of the platoon scanning a 120° sector.

The company commander's task is basically to supervise the company's evolution through its three basic formations in the course of combat action: from company column to platoon columns to all tanks in battle line, although platoons can be positioned to form echelon, "V" or wedge-type formations. The company commander also directs the firing of each platoon. The company tactics remain largely geometric and somewhat stylised, however. Tank companies, as an integral unit, do not have a second echelon or reserves in the attack. If operating as an advance guard, they frequently have a BMP-equipped motorised rifle platoon attached, plus a pair or more of SO-122s or ZSU-23-4s. In defence tank companies form three platoon strongpoints.

Soviet tank platoon tactics are extremely simple. The platoon leader's main duty is to supervise his platoon's execution of formation changes ordered by the battalion or company commander, and to direct and co-ordinate long-range fire with hand or radio signals. Soviet platoons, whether of three or four tanks, have two basic formations, column and line, although they can also form wedge, "V" and echelon.

Soviet tank platoon tactics consist basically of changing

from column to line and, if required, back again. A company is almost always used as a single unit: either a whole company moves or a whole company overwatches. Platoons are always used as a single unit, and the tanks always act together. Even on combat reconnaissance patrol the platoon will stay together, even though only one vehicle will go turret-down on skylines to allow the commander to observe. Because the platoon level of command does so little, the company is really the lowest-level Soviet tank unit that is capable of operating with any independence. In the 1980s, however, improved use of terrain and fire and movement by individual tanks within the platoon was seen as an achievable tactical goal.

Offensive tank tactics

Tank units attack as part of combined-arms forces and follow the principles of the Soviet high-speed offensive. The attack will be preceded by reconnaissance, planning at regimental or higher level whenever possible, and obstacle clearing. The artillery offensive will provide fire support, the preparatory fire being timed to hit enemy front-line defensive strongpoints from the moment the first tanks enter direct-fire range to when they are 150–200m away from the enemy position. Other artillery support will be provided by accompanying artillery. Overwatching tanks will support the attack, especially when strong resistance is expected. In this case a battalion will normally overwatch the attack of another battalion of the same regiment and provide fire support. Battalions or companies operating independently will use one or two of their sub-units as base of fire to support an attack by the rest of the unit, enveloping or outflanking whenever possible.

Fire and movement are the key elements of all tactics. In Soviet thinking about tank forces, movement brings advance, which brings victory. In the early 1960s the "fire" was to be provided by NBC strikes; tanks, moving quickly through contaminated areas, provided the movement. By the mid-1970s the development of new weapon systems – BMPs, SP howitzers and others – and improved logistics and resupply capability had allowed the Soviets to substitute a true combined-arms mechanised force for tank-heavy forces in following up such strikes. Without turning away from this capability, by the late 1970s, the Soviets had given tactical tank formations greater self-sufficiency in firepower, as shown by the provision of regiment-level artillery battalions and MRL batteries and the emergence of AT-8 Songster-armed versions of the T-64B and T-80.

How the new ATGM-armed tanks fit into Soviet offensive tank tactics is not clear. But it is likely that they will be used to combine the full range of normal capabilities with the role of long-range overwatch, especially against ATGM-armed vehicles. Equally uncertain is their level of integration: one company or platoon per regiment or battalion is most probable, although one battalion per regiment, or concentration in separate units comparable to the motorised rifle division's independent tank battalion, could also be possible.

Attacking tanks fire either from the halt, the short halt or on the move. Firing from the halt is usually only done by tanks on the defensive, when providing fire support, or when engaging enemy counterattacks. The halt lasts 60–90sec, enough time for a T-62 to fire four or five rounds and a T-54/55 three or four rounds. The improved two-plane stabilisation on T-64/72/80-series tanks gives them greater capability. After firing, the tank will move to avoid return fire unless it is in a camouflaged or dug-in position.

During an assault tanks will usually fire from the short halt, starting when they are 2,000–1,500m from the enemy position. The gun is aimed during the advance, and the tank halts only long enough, about eight to ten seconds, for the gunner to make the final adjustments and fire. The driver starts up as soon as he hears the sound of the gun. Tanks fire on the move (10–15km/h) if they have stabilised guns, while advancing on enemy positions less than 800–1,000m away, or in any situation in which it is too dangerous to stop or when weight of suppressive fire is more important than accuracy.

The attack itself includes three formation changes, from battalion column to company column, each company followed by a motorised rifle platoon if one is attached. They then deploy into platoon columns and finally into line, although weak enemy positions may be attacked in platoon or even company column to keep up momentum. Line, column and echelon remain the basic formations.

Tank offensive tactics increasingly include acting as forward detachments and *reydy*. The first company of each tank regiment is specifically trained to act in these roles, as is the independent tank battalion in motorised rifle divisions, which can do so either as an integral unit or broken down into detachments.

Defensive tank tactics

Whenever possible, large tank units will avoid being forced on to the defensive. If counterattacked, the Soviets will attempt to defeat the enemy in a meeting engagement rather than put a tank unit on the defensive and wait for the attack. If an area must be secured or defended, the Soviets will attempt to replace the tank units with motorised rifle units whenever possible. BMP-equipped units have even greater armour-killing firepower than tank units.

Soviet tank units defend in the basic Soviet pattern of defence in depth, although a regiment or battalion will frequently not have a third defensive echelon and the

reserves will counterattack from positions in the second echelon. If a defending battalion is in a single echelon, the reserves will be in the rear of the position.

Each defensive echelon is composed of the usual lines of strongpoints with overlapping fields of fire. Whenever possible, motorised rifle units will be integrated into these strongpoints, down to company level. Similarly, the four-tank platoons attached to motorised rifle companies are positioned as a single unit within the company strongpoint. If time permits, alternative firing positions will be prepared for each vehicle and, if there is engineer support, firing pits will be dug and camouflaged. Each battalion may deploy a tank platoon as an outpost 500m in front of the main defensive belt, while another platoon is often held in battalion reserve. Other tanks may be positioned as anti-tank ambushes, especially when the unit is covering a wide front or fighting a delaying action. Approach routes, gaps in the defences and exposed flanks are all good positions for anti-tank ambushes. Tanks are positioned in the defence to provide overlapping fields of fire in conjunction with ATGMs and other tank-killing weapons, their fire being concentrated on likely approach routes and in "fire pockets," where concentrated fire can defeat any potential breakthrough. Key terrain points are designated for massed platoon volleys. The spacing of 150m between defending tanks is intended to give overlapping fields of fire and vision when under armour.

An enemy attack will probably be preceded by probes which will be met by fire from the outposts in an attempt to conceal the strength and position of the main defences. If needed, each defending tank company will use a "wandering tank," manned by the best gunner in the company, to engage probes and patrols while the rest of the company remains concealed. Wandering tanks will displace within the company strongpoint after firing, one of the few occasions when Soviet tanks will fire independently at ranges over 1,500m. This may also be carried out, in more concentrated fires, by platoons of AT-8 Songster-armed main battle tanks.

Defending tank units may be subject to NBC or conventional preparatory fire. Tank units are considered to be capable of defending their assigned sectors even if they have suffered 30–40% losses. The overlapping fields of fire make it difficult for a large gap to be blown in the defences, and commanders will redeploy their forces until reserves or second-echelon forces can plug the gap.

Long-range fire against an attack will be conducted by the wandering tanks and any supporting ATGMs. The remainder of the Soviet tanks will open fire when the enemy is 1,500m away, or 1,000m if the tanks are in ambush positions or close terrain. Supporting motorised rifle units will simultaneously open fire to separate the enemy infantry from their tanks. A Soviet tank unit will only engage targets outside its own sector if it has first repulsed the attack in that sector. Soviet tanks rely more heavily on cover and camouflage than on displacement to avoid return fire. When alternative positions are available, they will displace every 60–90sec if the enemy fire is intense. If the enemy breaks into the position, the defending tanks may move to alternative locations within their strongpoints for flank defence, but a unit cannot do this, nor can it mount a counterattack, without approval from the next highest level of command, which may be difficult to obtain in the heat of action. The counterattack will usually be launched by the reserve or part of the second-echelon forces.

If forced to withdraw, a tank unit will use most of its first echelon as a rearguard, which disengages in turn when covered by supporting weapons and artillery fire.

Soviet tank development

Soviet tank development since 1941 has been basically evolutionary, updating different elements of the T-34 design to meet modern conditions. Effective weapons do not have to be high-technology, multi-function and technologically innovative, and Soviet tanks have maintained their effectiveness by remaining uncomplicated. Commonality of systems, standardisation of parts, and simplicity and ease of production are demanded by the very number of tanks the Soviet Army needs and the skill levels of the soldiers who will use them. Tank evolution has been based upon the improvement of existing types, with new systems and other innovations usually being introduced one element at a time. Parallel and independent development of improved-technology items continues in the meantime. All these elements are brought together and tested in experimental vehicles, minimising the risk of expensive and time-consuming technical failures.

Soviet tank development has succeeded throughout the years despite the inefficiencies created by the Soviet political and economic system. While the weapons development process itself is relatively flexible and autonomous at the level at which design, research and development are actually performed, higher policy-making levels often appear rigid and constrained in their methods. There is little motivation for risk-taking, and fulfilling the plan goals with the minimum effort possible could just as easily become the objective in weapons research and development, as it has in other aspects of the Soviet economy. That it has not happened is due to the efforts of the design bureaux and the importance that Soviet government, industry and society attach to weapons procurement and production. But they cannot escape entirely: lead times are long and development forecasts run seven to ten years in advance. Rigid, centralised planning gives little flexibility in reallocating or substituting materials, and the unreliability of supply from the civilian sector creates a reluctance to specify new

components or suppliers. Political influence also appears in weapons development.

The development and production of tanks does not escape the Soviet combination of splendid planning and often mediocre execution. The General Staff prepares the military aspects of the Long-Range Plan (the military, political and economic elements of which are integrated at Politburo level). It also produces the Strategic Long-Range Plan, which includes the broad direction of weapons development over the subsequent 15–20 years. The General Staff's Department for Planning, Organisation and Technology then prepares the military component of each five-year plan. Once approved by the Politburo, this is then administered by the Military Directorate of GOSPLAN, the State planning bureaucracy. The VPK also helps implement the plan.

There are high-level government administrative organisations to speed production, while military production ministries and plants attempt to be self-sufficient, so that failures in other sectors of the Soviet economy will not affect weapons production. The chief designer of each weapons system design bureau is important in this system. He supplies co-ordination, leadership and innovation, and possesses a degree of autonomy and command of resources that is rare in the USSR. He and his staff are closely identified with the success or failure of their designs.

The design bureaux do not work in a vacuum. Operational studies by the Defence Ministry (through its research establishments – including the Technical Institute for Armoured Technology at Kubinka Proving Grounds and the Military Transport Machine Building Research Institute at Gorelovo – and higher military schools) and technology-oriented research come from throughout the Soviet military-industrial complex. The conception of a new tank can be driven either technically (through new developments or research) or tactically (through the requirements of the General Staff). There are differing opinions in the West over which is paramount.

A new tank starts with a tactical-technical assignment written by a committee consisting of representatives of the Main Tank Directorate of the Army, Army headquarters, the General Staff, other administrative bodies and, possibly, operational commands. Once this requirement has been approved by the Defence Ministry, GOSPLAN, the VPK and possibly even higher levels, it goes to a design bureau. Before the project goes from "scientific-exploratory work" to the experimental design stage, the tactical-technical requirement is formulated.

Once advanced development is completed, the programme is reviewed. Competitions between different designs are often held at the design, prototype or pre-production stages. Extensive use is made of prototypes and pre-production models for full-scale development. Prototypes are tested and the vehicle is changed accordingly. Extensive "state trials" of pre-production equipment are conducted. If the state trials show that the

Above left: T-54 of the US Army. *(US Army)*

Above: T-55A tanks.

Left: Uparmoured T-62E of the "Prague" Regiment leaving Shindand, Afghanistan, in 1986 as part of the claimed withdrawal. The vehicle shown here has turret appliqué steel armour and stand-off plates over the suspension, as well as attachment points for mine-clearing or detection equipment. *(US Department of Defence)*

vehicle meets requirements, initial series production begins, with vehicles going to units for operational tests in which the troops are accompanied in the field by factory engineers. Only after changes arising from the operational tests have been incorporated does the Army accept the design and full-scale production begin.

Technical advances in Soviet tank design are gradually introduced and, if successful, tend to remain in service for a long time. The transmission, drive train and suspension of the T-62 are basically those introduced on the T-44 in 1944–45. The other features of the T-62 (tracks, stabilisation, snorkel, optics, night vision equipment, provision for mounting mine rollers, NBC protection, a turret basket, and many other elements) were introduced a few at a time in the different versions of the T-54/55. Of course, the T-62 features many of these innovations in a refined state of development and has also introduced new systems, most notably the 115mm smooth-bore gun. But even "new" items are often adapted from existing equipment. The D-10 100mm tank gun used elements from an earlier naval gun, and was used in the SU-100 assault gun before being fitted to tanks. The classic V-12 water-cooled diesel tank engine, with its lightweight block, is the same basic design authorised in 1932 and first produced at the Kharkov diesel works in 1938. An original Soviet design, the V-12 has appeared in many sub-types, but its output has not increased as fast as the size of the tanks it must power, rising only from 500 to 580HP in 20

years. Normally, only when the potential of evolutionary change is exhausted will a new approach be attempted.

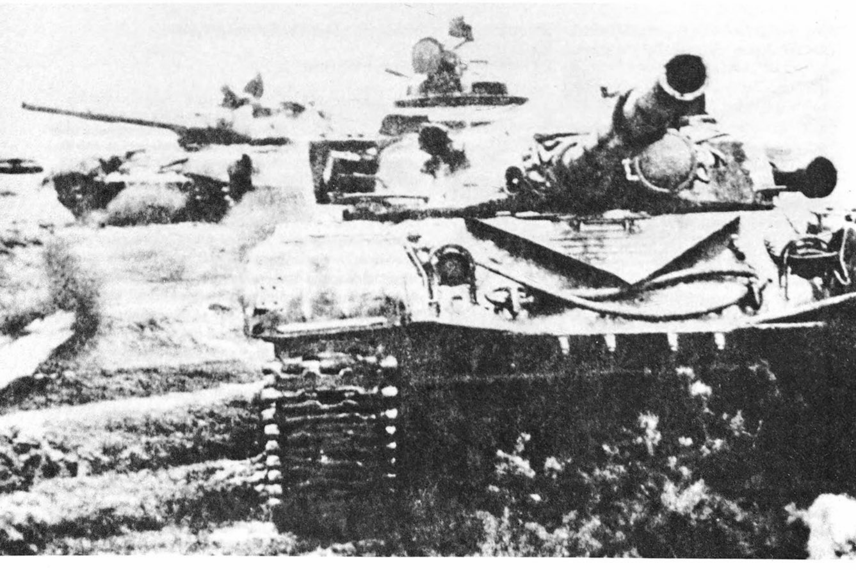
Active tank strength has levelled off at about 55,000 since the late 1970s, and it is probable that the norms for tank numbers are close to being achieved. Unless future expansion is planned, current production levels seem to have been set to allow replacement and modernisation of the force, while providing substantial numbers of tanks for export.

The Soviet tank force is so vast that it takes a very long time indeed for a particular design to be phased out. Even at the current high rates of production, it will take over 20 years to replace the existing force even if there is no expansion. This means that older tanks are going to be around for many years to come. The technical significance of the T-64/72/80 follow-on series should not obscure the fact that the T-62 and T-54/55 will also be met whenever the Soviet Army is engaged.

For reasons of economy, since the 1960s the Soviet Army has fielded a "high–low" mix of main battle tanks, with two or more types in production and still more in service. The T-62, with its high-performance smoothbore gun (an example of non-evolutionary development), was introduced as a high-capability, high-cost counterpart to the T-54/55 series, which were cheaper, somewhat (but not decisively) less capable, and more suitable for export. Its high cost is one reason why the non-Soviet Warsaw Pact countries never adopted the T-62. The T-64 may have been intended as a T-62 follow-on, but its development problems showed the Soviets the risks of combining several non-evolutionary design features in a single tank. It thus made sense that the more modern T-62 should leave production before the T-55, because the T-62 had already been replaced as the high end of the mix, first by the T-64 and then by the T-80. The T-55 was itself replaced at the low end of the mix by the T-72.

The high–low mix is mirrored by the Soviet Army's division into high and low-readiness formations. As new designs enter service, older tanks are trickled down to lower-readiness formations. The high-readiness divisions are concentrated in the Groups of Forces and the western military districts, the low-readiness divisions in the rest of the Soviet Union, where they are dependent for the bulk of their manpower on reservists with limited refresher training. The high-capability tanks go generally to the first category, while the less advanced types go to the second.

Export sales are extremely important to Soviet tank



T-72As on exercise. *(US Army)*

development. The export of arms is one of the primary money-earners – up to 25% of the national total – for the hard currency-poor Soviet Union.

The Transport and Heavy Machine Building Ministry, a "civilian" ministry, is responsible for tank production. There are four main plants: Nizhni Tagil, Kharkov, Omsk and Chelyabinsk (which was inactive in 1980–84). Of these, Nizhni Tagil is the largest, producing 83% of the total in 1980. Other factories are tooled up in readiness for any surge production.

Mothballs and training tanks

At any given moment most of the Soviet Army's tanks are in storage, effectively preserved against wear and environmental conditions. It takes 24 hours to remove a tank from storage and perform all the required checks before it is ready for action. Each tank is taken out of storage every six months, thoroughly tested and given any required maintenance, although the tanks are often damaged by poor maintenance. Tanks are removed from storage for large-scale manoeuvres (at least once a year), and also when they are rotated in their role as training tanks. Until at least 1984 the Soviets kept a large percentage of their tanks and other AFVs in Afghanistan in storage. Large-scale work in the vehicle parks warned the Afghan Resistance to prepare for an impending offensive.

Because most of their tanks are stored, the Soviet Army uses designated training tanks to maintain crew proficiency. One tank per platoon or, in lower readiness categories, one tank per company is removed from storage in rotation and used for training. Crews not using the training tanks are taught in classrooms, walked through tactical drills, or use wooden tank mock-ups with operating controls. Some units, especially those in higher readiness categories, have all or most of their standard tanks in storage and use a separate set of training tanks. In 1979–80 most of the T-64-equipped units in Germany kept most of these tanks in storage except for manoeuvres and retained their T-62s for training purposes. In wartime the T-64s would come out of storage and the T-62s could serve as pre-positioned equipment for personnel airlifted from the USSR or as war reserve stocks. However, it appears that most of the 1,200 tanks that the Soviet Union undertook to withdraw from East Germany in 1979 are training T-62s. In addition to tanks with their units, training and manoeuvre areas also hold numbers of training vehicles borrowed from unit storage or from stocks of withdrawn weapons.

This system prevents wear on first-line equipment and, given 24 hours' notice, almost every tank will be ready to go. Reportedly, whole regiments of Soviet-built tanks stay in their motor pools for weeks, receiving periodic maintenance – a "work on the treads" day, an engine oil system day, and so on – but when the regiments go on exercises, they do not leave a single tank behind. However, much valuable training time is wasted by not always having tanks available for each crew. It also prevents a crew from gaining intimate familiarity with their vehicle. This problem is more serious when the training tanks are different from the stored vehicle.

If the mass removal of Soviet tanks from storage is detected, it would provide warning of Soviet mobilisation. Thus, East German troops in the 1968 invasion of Czechoslovakia used T-34 training tanks rather than their stored T-54/55 first-line equipment when they went straight from manoeuvres to the invasion. The troops were probably more familiar with the T-34, and it prevented any possible security leaks.

The Soviet Army had only 3,000 tanks in war reserve in 1979. This figure may have doubled or trebled by the mid-1980s, following the replacement by more modern tanks of T-54/55-series vehicles with service life remaining. Yet it still appears likely that the Soviets do not plan to replace individual tank losses. If a division is burned out, then it will be pulled out and replaced by another. However, this reserve tank strength figure does not include the vast number of replaced tanks the Soviets keep in mothballs. The Soviets do not like to scrap weapons, and keep them stored for many years. Even T-34/85s still remain in mothballs, as was shown by the fresh examples exported to Angola, Somalia and other nations during the 1970s and to the PLO in 1980. In addition to providing tanks for export, the Soviets can raise the tank requirements of an estimated 25 war-only motorised rifle divisions from their mothballed tanks. They also take the place of first-line war reserves, so in a protracted war burnt-out Soviet divisions could be reformed with outdated tanks until Soviet industry could increase production to wartime levels.

In late 1976 Group of Soviet Forces Germany had 5,500 tanks, as many as 2,000 being T-64s. In mid-1978 there were 4,950 T-62s and 3,300 T-72s. In late 1979 the Soviets announced their intention of withdrawing 1,200 T-62s, some of which, it has been speculated, went to upgrade the equipment of the divisions that invaded Afghanistan (all figures are estimates). In 1986 GSFG was estimated to have 7,000 main battle tanks, about 2,000 of them T-80s. Most of the remainder are T-64s, with some T-62s, T-55s and, possibly, T-72s for training and in reserve.

The men inside the tanks

In tank combat the quality of the crew is often more important than the quality of the tank, a lesson of the Second World War since proven repeatedly in the Middle East. Effective training is the best single way of increasing

crew quality, but despite the increased education and technical competence of the Soviet conscript in the last decade, it is difficult to both train them effectively and to mould them into cohesive combat units in their two-year service. It is still possible that the limitations of Soviet tank crews may prevent the tanks from being used to full effectiveness. Tactics must thus remain simple.

Tank commanders receive six months' training before commanding their own vehicles, plus an additional course if they are platoon commanders. Gunners and driver-mechanics receive four months' specialist training, but the loaders receive only the standard 30-day basic training course before reporting to their units. In addition to his command function, the tank commander is the only crew member trained and authorised to use the radio. The driver-mechanic is responsible for automotive maintenance under the supervision of the company technical officer. The gunner is responsible for all weapons. The loader stores ammunition, aids the driver-mechanic and gunner and mans the anti-aircraft machine gun. There is no formal cross-training, but it is often done at unit level. Most cross-training is intended to allow the commander to take over the role of any other crew member. Other cross-training is also attempted, but only as training time, fuel and ammunition (all strictly limited) allow. In many units there are loaders only in company and platoon leader's tanks, owing to personnel shortages. This greatly reduces combat effectiveness as the loss of a crew member halves a tank's efficiency and the loss of two makes it almost useless.

In one Soviet tank unit gunners reportedly fire three full-size rounds a year to keep current, while their US counterparts fire 90–120 annual rounds, the Soviets emphasising sub-calibre firing instead. The Soviet average appears to be about 12 rounds per year. Training is largely dry runs and drills, backed up by rote memorisation of a limited number of tasks with specific steps. While many tasks are not adequately taught through these methods, others are.

All Soviet tankmen must be under 1.65m tall, although T-64/72 units appear to comprise men only 1.5–1.6m tall. Like all Soviet combat troops, they must not wear glasses. Even these small and strong men find the tanks cramped and fatiguing, especially when they are required to perform demanding tasks, such as the loader's having to pick up and seat rounds with his left hand or the driver's strenuous double-clutching. The average height of the Soviet population is less than that in the West, which makes recruiting such small tankmen easier.

Soviet tanks and their opponents

Since the late 1930s, Soviet tanks have been comparable to the best in the world, while the Soviets strove also to field large numbers. However, other factors undercut the Soviet numerical advantage, including less ammunition storage, much more primitive optics, lower rates of fire and inferior ammunition.

In the mid-1980s the T-64/72/80 main battle tanks featured a level of technology which – even if not comparable with that of their most formidable opponents, the M1 Abrams and Challenger, with Chobham armour, thermal sights and advanced stabilisation – is at about the same level as that of the M60A3 and Leopard 1, which will continue to equip much of NATO throughout the 1980s.

Until the advent of the T-64/72/80, the Western superiority in optics and fire-control systems gave NATO an advantage in tank combat. Not only was the Soviet equipment less sophisticated, but the quality and workmanship were often poor. Polish and Czech-built tank optics, though of the same basic design, were generally superior. Coupled with the often inadequate crew training, it meant that Western tanks would hit their opponents more often, a situation that will change when fighting the T-64/72/80, however. More important, perhaps, not only will Western tanks hit more often, they will hit first, which is the most critical factor at the ranges at which most tank combat takes place. This is because Soviet tank gun sights take longer to use accurately, their turrets take longer to traverse and their rate of fire is lower than that of Western tanks. Crew quality is also vital in "quick draw" situations.

The influence of fire-control systems and optics can be seen in these comparisons of a Belgian M48 tank using different types of rangefinder with its 90mm gun:

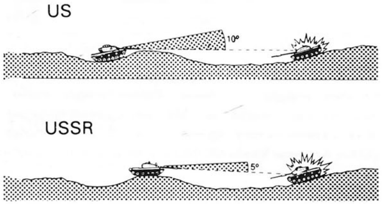
	Range		
Rangefinder	**500m**	**1,000m**	**2,000m**
Laser	98%	86%	34%
Stereo coincidence	97%	70%	14%
Stadia reticle	98%	34.5%	4%

The figures show the probability of hit by a stationary tank against a stationary 2.3m-sq target. Notice that at close range, where armour will not stop most penetrations, there is little difference between the systems, and the best crew – the one that fires first – will win. At longer ranges the differences become more marked, which is why NATO armour attempts to engage at long range and Soviet armour attempts to close with and engage the enemy as quickly as possible.

The smaller size of Soviet tanks makes them more difficult targets and limits production and operating costs. At the same time, they carry less ammunition than their Western counterparts. The Syrians were apparently running short of tank ammunition in the first days of the 1973 War, and the Soviets may do so in any future war,

especially if their advances have strained their resupply capability. Soviet tanks also lack the HEP/HESH, smoke, white phosphorous, canister and beehive rounds carried by Western tanks.

TANK GUN DEPRESSION



To hit the same target from identical defensive positions, the Soviet tank, with its limited tank gun depression, must come to the top of the height and expose itself.

The turrets of Western tanks normally rotate faster than those of Soviet tanks. An M60A3 turret rotates 24° per second, compared with 17° per second for a T-55 or T-62.

The lightness of Soviet tanks allows them to use bridges impassable to Western tanks.

Soviet tanks had more effective NBC defence systems than the Western tanks which preceded the present M1/Leopard 2/Challenger generation.

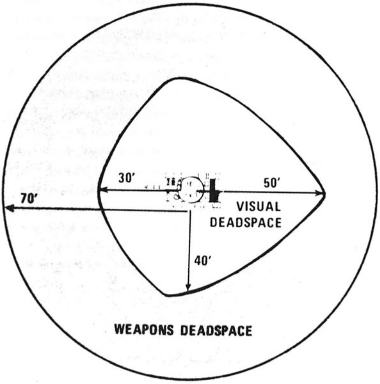
Soviet tank engines also take much longer to remove and change than comparable US-built engines.

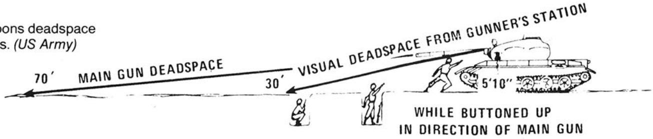
Compared with Western tanks, Soviet tanks have better cross-country mobility. Until the introduction of the T-64/72/80 series, their armour protection was normally less than that of Western tanks, but not to a significant degree. The introduction of Chobham armour in the late 1970s tipped the balance towards the West; the T-80 follow-on may change this. The human engineering of Soviet tanks is acknowledged to be inferior, as is their mechanical reliability: T-62s reportedly average one breakdown every 160–200km, as opposed to one every 240–320km for the M60A1. In the 1967 Middle East war 80% of Egypt's Soviet-built tanks were broken down when the Israelis attacked.

Soviet tanks generally require a major overhaul every 1,600km and factory rebuilding every 7,000km. T-55 and T-62 engines have a life of about 500–1,200 running hours, about a quarter the comparable US figure. The U-5TS gun barrel has a life of 120 rounds, compared to the NATO 105mm gun's 400 rounds. Soviet tanks are normally limited to about 250 miles running a year, giving them a peacetime design life of about 20 years.

Soviet tanks are cheaper than their Western counterparts, although comparisons can be misleading because of the "loss leader" pricing of Soviet military exports. Countries with which the Soviets have good relations, or which are targeted for penetration (the hardware comes complete with clouds of "advisers" or "trainers"), can have the weapons for less than cost. Other, less favoured, countries are charged what the market will bear in hard currency. Thus it is reported that Jordan paid four times what Libya did for its ZSU-23-4s and SA-8s.

In 1970, when an M60A1 cost $250,000, a T-55 cost





Visual and weapons deadspace from Soviet tanks. *(US Army)*

about $115,000 and a T-62 $175,000. In the early 1980s a T-72 was estimated to cost $1,000,000, half as much as an M1; other sources put the figure as low as $400,000.

The small dimensions of Soviet tanks appear to be both a means of reducing vulnerability by presenting a smaller target and of obtaining greater strategic mobility by allowing the use of railway rolling stock and tunnels that bigger tanks could not use. A smaller tank also allows the use of positions that bigger tanks could not use; in the Second World War the German Panther was unable to find many hull-down positions in the Ukraine because of its size, and wartime experience undoubtedly influenced Soviet tank design. But the Soviets pay for this advantage with a cramped and vulnerable interior and, more important, the low silhouette limits gun depression to four degrees, as opposed to ten or more degrees in Western tanks. This forces Soviet tanks to expose much more hull than Western tanks when firing from defilade "hull down" postions. This means that Soviet tanks will not be able to use many advantageous positions and, by increasing their exposure, the low silhouette may have actually increased vulnerability instead of decreasing it. Of course, Soviet armour is an offensive weapon and is not intended to be used on the defensive or in defilade except temporarily, and the tanks themselves seem to be designed more for the plains of the Ukraine or Manchuria, the scenes of wartime experience, rather than the hills and heath of Western Germany. In many positions, any tank will have to fight on the top of a height or on the side towards the enemy, regardless of the available depression. In addition to these drawbacks, the small height of Soviet tanks, coupled with their small tank commanders, limits the distance a Soviet tank commander can see while standing up in the turret to at least 1,000m less than what an M60A3 commander can see. The lower mounting of Soviet tank guns also means that firing throws up a bigger dust cloud, which often blocks the gunner's vision, as he is also closer to the ground.

The characteristics of some US tank-killing systems in comparison with Soviet tanks and other AFVs are given in the following tables:

M60A3

Combat weight 52.6 tonnes **Ground pressure** 0.87kg/cm² **Power/weight ratio** 14.24hp/tonne **Height** 3.27m **Max road speed** 48km/h **Road range** 480km **Armour basis** (glacis) 225mm, (turret front) 250mm, (turret side) 138mm, (hull side) 53–48mm, (turret rear) 58mm, (turret top) 23mm

M1A1

Combat weight 57.1 tonnes **Power/weight ratio** 26.24hp/tonne **Height** 2.9m **Max road speed** 66.8km/h **Max cross-country speed** 48.3km/h **Road range** 465km **Armour basis** Chobham armour, equal to 450% as much armour plate

M113A1

Combat weight 11,156kg **Ground pressure** 0.55kg/cm² **Power/weight ratio** 19.27hp/tonne **Height** 2.5m **Max road speed** 67km/h **Road range** 483km **Armour** (hull front) 38mm, thinning to 12mm elsewhere. All armour of aluminium, equal to approximately 38% its thickness of steel.

Probability of a hit killing a Soviet tank:

105mm APDS	54%
105mm HEAT	75%
TOW	90%
Dragon	80%
LAW	33%

Probability of hit by US tank-killing weapons (approximate) against Soviet tanks (stationary firing at stationary targets):

		Range (metres)								
Weapon	**Ammunition**	**50**	**250**	**500**	**1,000**	**1,500**	**2,000**	**2,500**	**3,000**	**3,750**
105mm gun	APDS	97%	94%	94%	86%	61%	44%	25%	8%	1+%
105mm gun	HEAT	97%	92%	89%	69%	50%	28%	17%	3%	nil
105mm gun	HEP	97%	92%	89%	56%	47%	28%	17%	3%	nil
TOW (HAW)	HEAT	nil	75%	90%	90%	90%	90%	90%	90%	90%
Dragon (MAW)	HEAT	nil	75%	90%	90%	nil	nil	nil	nil	nil
M72A2 (LAW)	HEAT	97%	17%	nil	nil	nil	nil	nil	nil	nil

Armour penetration (mm) (approximate):

	Range (metres)					
	500	1,000	1,500	2,000	2,500	3,000
105mm APDS	300	275	250	225	200	175
105mm HEAT	425, any range					
TOW	500, any range					
Dragon	500, any range					
LAW	305, any range					

The use of stabiloy penetrators or HVAPFSDS rounds for the 105mm will greatly increase penetration, as will the use of improved warheads for ATGMs.

The future

Keeping the tank a valid and potentially decisive force in the face of the increasing lethality of modern conventional weapons is a priority in Soviet tactical and technical development. Nor will the effort be limited to more tanks and better tanks. Technical development will probably continue to follow two tracks, producing a high-cost, high-capability follow-on to the T-62/64/80, and a successor to the T-55/72 which will be cheaper, more suitable for export, and embodying technology originally developed for the high-cost line as it becomes more economical. The older high-cost tanks will also trickle down to join lower-cost designs in lower-readiness formations.

The Soviets still believe that the tank is the weapon of decision, even in the face of the ATGM and the precision-guided munitions that have appeared in the last decades. One Soviet view postulates that the chance of victory is dependent on how many tanks can attack per kilometre of frontage, and how many anti-tank weapons per kilometre oppose them.

Probability of success, tanks v. anti-tank weapons:

Tanks attacking per kilometre of front	Anti-tank weapons per kilometre of front					
	5	10	15	20	25	30
15	50%	2%	nil	nil	nil	nil
20	75%	10%	1%	nil	nil	nil
25	92%	30%	5%	1%	nil	nil
30	98%	50%	10%	2%	nil	nil
40	100%	75%	65%	10%	3%	1%

This table – from Soviet sources – shows that the chance of victory, here expressed as a percentage, can no longer be improved by mass alone. The Soviets seldom attack with more than 20 tanks per kilometre, and most NATO mechanised infantry battalions can field 15 tank-killing systems per kilometre. Massing more tanks will simply make a better target for NBC and conventional weapons. It is also obvious why the Soviets have emphasised outflanking and enveloping defensive positions rather than attacking them frontally. But if the Soviets must attack, they intend to reduce the number of anti-tank systems through artillery suppression. They appear to have decided in the late 1970s that artillery was the most significant single tactical means to keep the tank an effective offensive weapon. They estimate that, following the lifting of a barrage, it will take 60–90sec for an opposing ATGM or 120–180sec for an AFV to be ready for action. If the Soviet tanks follow the barrage at the required 200m safety margin and a speed of 15km/h, they can overrun the position before it can respond.

Surprise will also be exploited to the full: anti-tank systems will be of little use if they are not prepared. Technical innovations, especially compound armour, may also make each tank as effective as, perhaps, two earlier tanks in the equation of victory. The fact that the Soviets have followed all these courses shows that they are aware of the dynamics of the modern battlefield and have continuously altered their thinking to suit it.

Soviet armour is not without its limitations. Its stereotyped company and platoon tactics make the tanks excellent targets, fail to make the best use of terrain, lack flexibility and, in the words of the US Army, "should be relegated to history". Against even an outnumbered defender, predictable, textbook tactics will be disastrous. The Soviets realise this – hence their emphasis on surprise, manoeuvre and suppression – but they cannot, or will not, change their tactics. Tank crew skill superiority totally undermined numerical advantages in the Second World War and the Middle East. While Soviet tank crews are much better trained and far more technically proficient than their Second World War predecessors or those of Arab armies, they are still not equal to those in some Western armies.

Logistics and mobility will also have to be improved. The increasing use of tank transporters means that the Soviet Army is less dependent on railways for strategic and operational mobility. The widespread failures apparent in the 1968 invasion of Czechoslovakia led to extensive changes in the logistics system and to increased emphasis on means of bringing formations from the Soviet Union to the front line. Starting in the early 1970s, manoeuvres have featured long-distance motor marches. One T-62 equipped regiment moved 320km on its tracks in 24 hours and only two tanks – one with a burnt-out engine, the other with a blown transmission – failed to complete the move. The terrain of West Germany, with its valleys, defiles and many choke points, is hardly the ideal location for mobile warfare, especially in the US sector. Tanks may be able to move cross-country, but the trucks carrying their POL and ammunition cannot. The increased emphasis on helicopters is only a partial answer.

Combined-arms integration will undoubtedly be strengthened in the future. The answer to the emerging-technology weapons that threaten tanks will be found more in surprise, speed, shock and manoeuvre, and in the use of artillery, helicopters and special forces, than in improvements to the tanks and their tactics.

The emergence of improved armour in the 1970s has affected the balance between tanks and anti-tank systems. To penetrate this armour may require new weapons and capabilities, but it is likely to be other tanks that will carry these weapons. The tank will probably remain the best anti-tank weapon and the keystone of the armoured offensive for the rest of this century. Yet to achieve and maintain this capability in an increasingly complex battlefield may require tanks so sophisticated and expensive as to call into question the continuing validity of the Soviet concept of the mass armoured army.

Soviet tanks in Afghanistan

The tank has played a central part in the Soviet war in Afghanistan. The initial invasion forces brought their organic tank regiments and battalions, equipped mainly with T-54s and T-55s. They soon found the limited elevation of their main guns a great drawback in mountainous areas and, despite years of emphasis on the importance of combined-arms tactics, are reported to have acted without motorised rifle support in the first months of the war. Despite poor tactics and lack of anti-tank weapons, the Resistance were able to destroy a large number of tanks in 1980. One tank regiment was withdrawn from Afghanistan in 1980 but subsequently returned.

It appears that by 1986, however, only one division in Afghanistan had its full organic tank regiment. This, the "Prague" Regiment of the 5th Guards Motorised Rifle Division, made a well-publicised "withdrawal" from Afghanistan that year. In reality, like the other tank regiments, it simply shifted its flag to the Soviet side of the border but remained in action.

The T-55s have been joined in the course of the war by numbers of T-62s (reportedly ex-GSFG), now the predominant type. Small numbers of T-72s have been in action, possibly in divisional reconnaissance units.

Following the initial period, tanks have been used to defend Soviet positions such as airfields or bridges, escort convoys and, most importantly, support combined-arms offensives. As a result, tanks have taken part in all the major offensive actions of the war.

The main threats to tanks in Afghanistan are mines and hand-held anti-tank weapons, especially the RPG-7. Both are normally used in ambushes. On at least one occasion during the Panjshir V offensive of 1982, a Soviet tank unit failed to take up proper night positions but rather just pulled off the road and pitched tents, allowing the Afghans to work up to them with RPG-7s and machine guns for a night attack. The need for an answer to the RPG-7 threat has led to the additional armour seen on T-55s and T-62s in Afghanistan. Both types have acquired armoured fabric skirts and additional armour around the turret ring and face and on the belly.

The tank and other tactics used in Afghanistan have revealed a reluctance to take casualties that is not often associated with the Soviet Army. Many are the Afghan roads that bear the marks of tanks which have about-turned upon drawing fire. In 1980–83 especially, tank units operating as convoy escorts would often not leave the road to manoeuvre against ambushes, preferring to stand off at a distance and shell the ambush position. Plastic anti-tank mines have apparently been hard to counter, except by painstaking lifting or the use of mine rollers.

Since 1984, however, tank tactics have become more aggressive. Tanks were used to spearhead many of the key offensives of 1984–88: Panjshir VII, Barikot and Khost. These offensives frequently advanced, quite slowly on a one-tank frontage, with helicopter-inserted forces seizing heights along the route, motorised rifle or airborne troops in close support, helicopters overhead, and extensive preliminary bombardments by artillery and fighter-

This T-55 was knocked out by Afghan guerrillas in Paktia province in 1980. Soviet mechanised forces suffered significant losses in some of their initial battles with the Afghans in early 1980, tanks often being committed without proper combined-arms support. *(National Islamic Front of Afghanistan)*

bombers. This shows that, in Afghanistan as elsewhere, the Soviets will look to a range of weapons and tactics to counter threats to tanks.

In Afghanistan Soviet tank units have suffered both the tactical frustrations which they share with the rest of the army, and those inherent in the use of armour in counter-insurgency operations. While improving guerrilla weaponry and tactical skills meant that losses increased in 1984–85 – especially in the border fighting of the latter year – the tank remains a crucial element of Soviet tactics in Afghanistan.

Unit organisation

Tank platoon

Total strength: one officer, 11 enlisted men, three tanks; except in the tank battalions of motorised rifle regiments: one officer, 15 enlisted men, four tanks. Warrant officers or sergeants are often substituted for junior lieutenants as platoon leaders. The remaining tanks are normally commanded by sergeants. Some of the drivers and gunners will be PFCs. Each crewman has an AKSU or AKMS and five grenades stowed inside the tank. The tank commander often carries a pistol. T-64/72/80s have three-man crews.

Tank company

One company HQ
Three tank platoons
Company HQ consists of: one tank, commanded by the company commander (Snr Lt or Capt) and driven by a PFC (gunner is also often a PFC); one deputy commander (Snr Lt or Lt, political officer); one technical officer (Snr Lt or Lt); one administrative warrant officer; one clerk and one tank driver (privates). The last five men ride in the company's Ural-375 or ZIL-157 truck, and do not accompany the command tank in action. The company commander sometimes also has a GAZ-69, driven by his tank driver, for non-combat duties.

Tank battalion

One battalion HQ (5–7 officers, 17/18 enlisted men)
Three tank companies (five in independent tank battalions; may be increased to four in some Category I units)
One supply and maintenance platoon
One medical section
Battalion HQ, like all Soviet unit HQs, is divided into forward, main and rear CPs in combat:

Forward CP: battalion commander, plus three enlisted men, in a special "K" command tank. Commander is usually a major, sometimes a captain or lieutenant-colonel. One GAZ-69 is provided.
Main CP: one special "command" tracked APC (usually BMP, BTR-50 may still be used) or BRDM (less likely) containing chief of staff (Snr Lt or Capt), operations officer, signals officer, political officer, NBC officer (all Lts) and one enlisted driver. A second APC/BRDM and driver may be provided as well.
Rear CP: technical deputy commander (Snr Lt or Capt)
Supply and maintenance platoon (3 officers, 31–33 enlisted men, 1 ARV-T, 6+ Ural-375 or ZIL-157 truck, 3 POL tank trucks, 1 maintenance truck, 1 BRDM or APC for rear CP (2 RPG-16)
Medical section (1 warrant officer [*feldsherr*], 8 enlisted orderlies and drivers, 1 ambulance)

1 Independent tank battalions differ from those in motorised rifle regiments in having organic engineer sections (10 men, 1 AVLB, 1 BTM/MDK-2 ditching machine, 1 BAT/BAT-M dozer), a communications platoon (10 men, 1 BRDM-2, 1 jeep, 1 GAZ signal van, 1 R-104M, 1 R-130 and 1 R-123) and an extra ARV-T in the maintenance section.
2 At least some divisional independent tank battalions use the 40-tank organisation.
3 The small size of a tank battalion HQ may mean that it would have to be reinforced with higher-level C-cubed assets if the battalion were to be used for an independent mission.
4 Reports in the early 1970s suggested that it was proposed to add a four-tank platoon armed with ATGMs such as AT-8 Songster. This would have led to an increase in battalion strength from 31 to 35.

Tank regiment

Total strength: 1,575 officers and men, 95 MBTs, 18–24 122mm SP howitzers, 0–6 M-1976 MRLs, 39 BMP IFVs, 19+ jeeps, 102+ standard and specialised trucks.
One regimental HQ (28 officers, 32 enlisted men, 2 "K" command tanks, 4 BRDMs, 2 tracked CP APCs or BMPs [may replace BRDMs], 8 GAZ-69, 3 SA-7/14 launchers, 3 ZIL command vans, one BTR-60PA or BMP for Air Force representative, 1 Ural-375 or ZIL-157)
Three tank battalions
One motorised rifle battalion (with BMP-series vehicles; battalion not included in tank regiment of motorised rifle divisions)
One SP howitzer battalion
One 122mm MRL battery
Combat support units
One anti-aircraft battery
One reconnaissance company
One engineer company (with 27 mine roller-plough combinations and 9 dozer blades, issued to tank companies and battalions as required)
One signals company (4 officers, 53 enlisted men, 3 command APCs or BRDMs, 3 motorcycles, five jeeps, three GAZ-66, 3 GAZ-66 vans, 2 ZIL signals vans, 2 R-104M, 2 R-130, 7 R-107, 2 R-401/5, 1 high-power van-mounted HF, 1 medium-power vehicle-mounted HF/VHF, 2 vehicle-mounted high-power HF/VHF)
One NBC defence company
Service support units:

One transport company (5 officers, 69 enlisted men, 2 GAZ-66 and 40 larger trucks, including 15 POL tank

trucks and 1+ semi-trailers)
One medical company (4 officers, 33 enlisted men, 6 trucks and ambulances)
One maintenace company (4 officers, 70 enlisted men, 5 ARV-Ts, 1+ GAZ-69, 14+ maintenance vehicles and jeeps)
One traffic control platoon (1 officer, 19 enlisted men, with APCs or trucks)
One supply and service platoon (1 officer, 11 enlisted men, 7+ trucks, 1 jeep)

Regiments always use a single type of main battle tank. However, training tanks may be of a different type from the standard equipment. It may be that the fourth tank company in battalions deploying such a company could be made up of training tanks, which would result in some battalions using two different types of tank.

It has been reported that Soviet tank regiments are being reinforced with a regimental 122mm SP howitzer battalion. Such battalions were present in a number of regiments in tank divisions in East Germany in 1979–80.

Tank division

Total strength: 11–12,000 personnel, 328 (328) main battle tanks, 4 FROG/SS-21, 18 (48) 152mm SP howitzer, 72 (96) 122mm SP howitzer, 36 (0) D-30 122mm howitzer, 18 (24) BM-21 MRL, 24 M-1976 MRL, 4 Vasilesk, 36 M-1943 or 2S12 120mm mortar, 20 SA-6/8/11, 16 SA-9/13, 93 SA-7/14, 16 ZSU-23-4, 9 ATGM-armed BRDMs, 469 RPG-7/16, 36 AGS-17, 526 RPK-74 LMGs (in units using 5.45mm weapons), 6 Hoplite, 6 (8) Hip, 6 (8) Hind (in divisions with a helicopter squadron), 95 (124) BMP/BRDM/BTR command vehicles, 7 (19) BRMS, 240 (228) BMPs, 23 BTRs, 4 air-control BTR-60PA, 8 PRP-3 with Small Fred, one SP Big Fred, 28 (29) BRDM scout cars, 40 ACRV-2s, 161 GAZ-69/UAZ-469 jeeps, 288 GAZ-66, 355 ZIL-130/131/151/157, 331 Ural-375, 1 KrAZ-214/255, 255 KrAZ/ZIL/Ural/KamAZ trucks, 81 GAZ vans, 73 ZIL/Ural command vans, 24 ZIL signals vans, 161 ZIL maintenance vans, 10 UAZ-452 command vans, 20 kitchen vans, 1 ATGM simulator van, 9 hospital vans, 4 bakery vans, 1 generator van, 240 POL trucks, 35 ARS-12/14, 14 DDA-53/66, 2 TMS-65, 10 DKV, 29 BRDM-2rkh/RKhM, 2 UAZ-469rkh, 74 LuAZ-450/452 ambulance, 29 water tank trucks, 2 KrAZ-214/255 tractors, 10 K-61 cranes, 8 Ural-375 crane trucks, 10 E-305V crane shovel trucks, 11 dump trucks, 2 ZIL-157 recovery trucks, 1 sawmill truck, 1 water purification truck, 3 DIM mine detectors, 15+ missile reload carriers (dependent on SAM type), 15+ missile transloaders, 6 staff cars, 40 motorcycles, 24 ARV-Ts, 4 FROG/SS-21 reload carriers, 3 MTP ARVs, 1 AT-S tractor, 2 IMR, 10 AVLB, 24 TMM, 6 GSP, one PMP set, 13 K-61/PTS-M, 8 BTM/MDK, 12 BAT/BAT-M/PKT, 12 BTU dozer blades, 2 D-144 graders, 12 PZM bucket excavators, 2 UR-67/77, 54 KMT-4/6 sets, 18 KMT-5M sets, 1 piledriver set, 3 GMZ, 12 PMR-3, 10 NDL-10 assault boats, 1 sound-ranging set, 9 battlefield surveillance radars, 1 counter-battery radar, air-defence radars (dependent on SAM type), 9 VHF/UHF signal intercept receivers, 3 HF/VHF/UHF radio DF sets, 4 radar DF sets, 4 R-118 van-mounted HF radios, 18 R-401/405/409 radio relay, 67 R-104M manpacks, 98 R-126 manpacks, 368 R-107 manpacks.

Numbers in brackets above show strengths for divisions in GSFG and, probably, other high-readiness divisions in Eastern Europe and the western military districts. These changes reflect the move to 24-weapon artillery battalions and a reorganised BMP regiment. The GSFG and other high-readiness divisions' artillery is all self-propelled, whereas in the other divisions there are two D-30 battalions in the divisional artillery regiment. Other tank divisions are however significantly weaker. Lower-readiness tank divisions are likely to lack helicopter squadrons and SP howitzers, and, like all such Soviet divisions, may be missing complete units or sub-units.

One divisional HQ (245–303 personnel, 6 SA-7/14, 3 RPG-7/16, 3 LMG, 3 BTR command vehicles, 12 jeeps, 28 trucks, 12 command vans, 9+ armoured command vehicles [in high-readiness divisions at least]).
Three tank regiments
One motorised rifle regiment
One artillery regiment
One FROG/SS-21 battalion
One anti-aircraft regiment
One helicopter squadron
One reconnaissance battalion
Combat support units
One engineer battalion
One signals battalion
One NBC defence battalion (225 personnel, 4 jeeps, 1 GAZ-66, 21 ZIL trucks, 2 vans, 2 maintenance vans, 4 POL trucks, 1 ambulance, 20 ARS-12/14, 4 DDA-53/66, 2 TMS-65, 2 DKV)
Service support units:
One supply and service battalion (combines transport and logistical functions) (33 officers, 340 enlisted men, 6+ jeeps, 33 GAZ-66, 30 ZIL-130/131/157, 120 Ural-375, 9 maintenance vans, 80 POL trucks, other specialist trucks, trailers for all trucks, flexible storage tanks, field refuelling systems)
One medical battalion (35 officers, 123 enlisted men, 1+ light truck, 19+ trucks and ambulances)
One maintenance battalion (19 officers, 275 enlisted men, 5 jeeps, 27 trucks, 42 maintenance vans, 4 POL trucks, 2 ZIL-157 recovery trucks, 3 Ural-375 crane trucks, 5 ARV-T, 1 K-61/PTS)
One traffic control company (3 officers, 57 men with trucks and APCs)
One field bakery (2 officers, 38 enlisted men, 6 trucks)
One medical battalion (35 officers, 123 enlisted men, 31 trucks)

One divisional band
Divisional depots
Divisional service support elements

"Unified corps" tank division

Total strength: 17,500 personnel, 450-plus main battle tanks, 600-plus BMPs and APCs, 300-plus artillery pieces and MRLs.

One divisional headquarters
Four to six combined-arms brigades
One artillery brigade (possibly with multiple regiments)
Combat support and service support elements similar to those of "standard" high-readiness tank division but all probably enlarged to support activities of a division almost twice as big as normal.

One of the most significant recent changes in the Soviet Army was the reorganisation, by 1981, of two tank divisions based in the western military districts of the USSR into formations intended for exploitation or for action as OMGs. These divisions are reported to be organised similarly to Second World War tank corps, with four combined-arms brigades, each intended to be capable of independent action.

These brigades may resemble the 66th and 70th Motorised Rifle Brigades, which have seen much action in Afghanistan, possibly testing the new organisation. They each have three or more manoeuvre battalions (one tank, two or three motorised rifle, one or more trained for air assault); one or more artillery battalions (tube and MRL), and a full range of supporting units.

The brigades probably command, between them, 14 tank battalions, 10 motorised rifle battalions and 15 tube artillery, MRL or composite tube/MRL battalions, all probably organised in the same way as battalions in high-readiness tank divisions. Some of the motorised rifle battalions may be trained in the air assault role, or there may be a number – perhaps three to six – air assault battalions organic to the division. All motorised rifle battalions not intended to have a primary air assault role are probably mounted in BMPs. The brigades may all be similarly organised or may have specific tank, air assault and motorised rifle organisations.

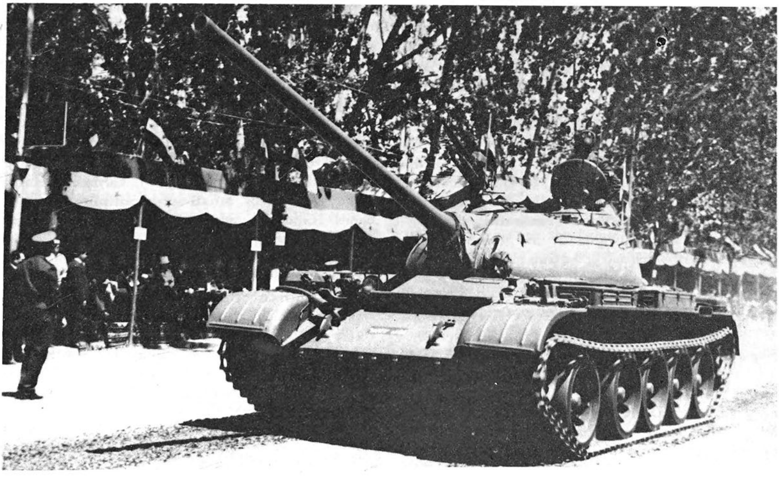
Two of the divisions, probably located in the Byelorussian and new Kiev military districts, were known to be in the Soviet order of battle in the early 1980s. There have since been reports of the creation of a third such division in the same way as the first two, by the upgrading of an existing tank division, in the Far East Military District.

As of 1987, it appeared that none of these new divisions was subordinate to army headquarters, but would rather be directly under front or higher command.

Independent tank brigades and regiments

Independent tank brigades have about 150 main battle tanks, without artillery or service support and usually without motorised rifle troops. Independent tank regiments probably have about 90–100 tanks. They are usually attached to army or front HQ as a reserve.

A basic T-54 of the Syrian Army passes in review. The small hull machine-gun mount is visible below the fording splashplate.



A T-55A(M) of the US Army with 12.7mm machine gun and two searchlights but with the fording splashplate deleted. (*US Army*)

T-54/55 main battle tank

Combat weight 36 tonnes **Length (gun forward)** 9.0m **Length (gun rear)** 8.485m **Height (without AAMG)** 2.4m **Width** 3.27m **Track** 2.64m **Clearance** 0.425m **Track width** 0.58m **Ground contact** 3.84m **Ground pressure** 0.81kg/cm² **Max road speed** 48km/h **Fuel capacity (internal)** 580 litres **Fuel capacity (external)** 320 litres (less on early T-54) **Fuel capacity (jettisonable rear drums)** 400 litres **Fuel consumption (paved roads)** 1.9+ litres/km **Fuel consumption (unpaved roads)** 2.8+ litres/km **Fording** 1.4m **Snorkelling** 5.5m (4.6m with earlier equipment) **Gradient** 37° **Turning circle (at 10–15km/h)** 8.02m **Vertical obstacle** 0.8m **Trench** 2.7m **Power/weight ratio** 16.11hp/tonne (14.44) **Engine** V-55 (V-54) V-12 diesel, water-cooled, 580 (520) hp @ 2,000rpm, 38,600cm³ **Range (paved road)** 420km (without extra tanks), 660km (with extra tanks) **Range (unpaved road)** 325km (without extra tanks), 610km (with extra tanks) **Transmission** Mechanical synchromesh, 5 forward, 1 reverse gears **Steering** 2-stage planetary clutch and brake **Gun** 100mm D-10T2S (T-54 had earlier versions) **Calibre length** 56cal **Max rate of fire (theoretical)** 7rpm **Max rate of fire (actual)** 3–4rpm **Max range (direct fire)** 2,800m (APDS), 2,200m (HEAT), 2,200m (APHE), 2,200m (Frag-HE) **Effective range** 1,200–1,300m (APDS), 900m (HEAT), 1,080m (APHE) **Max range (indirect fire)** 21,031m (Frag-HE) **Ammunition types** BM-6 HVAPDS, BR-412D/BAPHE, BR-412P HVAP, BK-5M/4M HEAT, OF-412 Frag-HE, D-412 smoke **Muzzle velocity** 1,415m/sec (HVAPDS-T), 916m/sec (APHE), 900m/sec (HEAT), 900m/sec (Frag-HE) **Shell weight (projectile/round)** 5.7/21.1kg (HVAPDS-T), 15.9/29.9kg (APHE-T), 10.23/?kg (HVAP), 12.4/25.5kg (HEAT, BK-5M), 15.9/28.0kg (Frag-HE) **Ammunition load** 43 (34) rounds = 23 APHE or HVAPDS, 3 HEAT, 17 Frag-HE (approx 11 APHE, 3 HEAT, 20 Frag-HE) **Co-axial MG** 7.62mm PKT (SGMT) **AA MG** 12.7mm DShKM **Bow MG** None (7.62mm SGMT) **7.62mm ammunition** 3,500 rounds (5,000) **12.7mm ammunition** 500 rounds **Small-arms ammunition** 300 rounds **Hand grenades** 20 **Main gun elevation** −5°/+18° (−4°/+17°) **Traverse** 360° **Turret mechanism** Electro-hydraulic (manual in early T-54) **Armour** 100mm @ 60° (hull front), 205mm rounded (210mm rounded) (turret front), 80mm @ 0° (hull side), 20mm @ 0° (lower hull side), 130mm rounded (110mm rounded) (turret side), 60mm @ 0° (hull rear), 60mm rounded (turret rear), 33–16mm (30–20mm) (hull top), 30mm (turret top), 20mm (hull floor) **Crew** 4 **Radio** R-123, plus R-113 or R-112 in company command tanks.

All figures for T-55A, retrofitted with AAMG. Where T-54 figures differ, they are in parentheses. There are variations between models and sub-types.

These tanks have been produced in large numbers – possibly over 100,000 of all versions – and have seen more combat than any other post-war tank series. Today, despite its simplicity, ruggedness and mobility, the T-54/55 series is at a disadvantage compared to more recent designs. They are cramped, often "brew up" if hit, have a springy suspension that creates crew fatigue, are tiring to drive, shed tracks and are prone to engine over-heating. They lack air conditioning and are much less effective in desert conditons. The 100mm D-10-series gun lacks long-range accuracy and armour penetration. Its rate of fire is low and its optics are inadequate except at close range.

Many foreign users of the T-54/55 series are seeking to correct these deficiencies. The Soviets have also modified and retrofitted equipment to their T-54/55s so that, for all their limitations, they are still important and viable weapons systems. T-55s especially are still in widespread Soviet service.

Hull and turret

The T-54/55's hull is made of welded rolled steel plates and is divided by bulkheads into two compartments: crew and engine/power train. The design minimises ballistic vulnerability. This is evident in the interlocking joint between the glacis and the nose plates and the "half-egg" turret, which replaced an unsatisfactory enlarged version of the T-44 turret that appeared on prototype and early production T-54s. All T-54/55 turrets have standard Soviet external rails for hand grips and storage.

While the turret design provides a low silhouette and good protection despite its relatively thin armour, it is cramped and reduces crew effectiveness. The T-54 has no turret basket, which means that the floor of the fighting compartment does not revolve with the turret. Ammunition stored in the hull may be inaccessible when the turret is rotated. Crewmen not in the leather seats suspended from the turret roof run the risk of being crushed by the rotating gun breech.

Unlike Western practice, the gunner and commander sit on the left-hand side of the turret, almost in each other's laps. The loader sits on the right of the gun, which means he must not only seat and ram home 25kg shells with his left hand, but, once the three ready ammunition rounds stowed inside the turret wall have been expended, he must leave his seat, risking being crushed by the breech, to haul shells out of the storage racks in the hull, thus reducing the rate of fire.

Spent shell brass is not ejected from the turret, and will be underfoot, making the loader's footing uncertain. The introduction of the partial turret basket and standard seats in the T-55 made loading the 100mm gun easier, but it still has to be elevated after each shot to give the loader room to extract the spent brass and reload, a time-consuming process, especially in early models which lacked power elevation.

The turret also contains the ready ammunition rounds and the radio, further reducing space. The T-54A and later versions also feature a fire-extinguisher system in all compartments similar to that on the T-62.

Engine and transmission

The transversely mounted engine is the V-54 in T-54s and the V-55 in T-55s. Both engines are water cooled, 4-stroke, 12-cylinder, 60° vee diesels with a capacity of 38.88 litres. The V-54 develops 520hp at 2,000rpm, while the V-55 produces 580hp at the same revolutions. Both engines are constructed largely of light metal. The block is of magnesium-aluminium alloy, which is light but vulnerable to fire.

Soviet tank engines, especially those on the T-54/55s and earlier tanks, suffered from crude workmanship and finish, which caused stress cracks and resulted in high oil consumption, especially at high speeds. The Czech Army found that Soviet-built engines had a life of only 100 hours (instead of the 500 hours claimed) unless they were rebuilt upon delivery. Eight to ten ounces (230–280g) of metal filings have been removed from these engines after only 25 hours' running time.

The interior oil lines are so rough that the flow is often blocked. This overstresses the pump, which often breaks down, causing the engine to overheat or seize from lack of oil, and, because of its magnesium alloy construction, many engine fires result. These consume the engine block, totally destroying the engine. Other less spectacular breakdowns are also common.

The Czech Army attempted to overhaul these engines by replacing all bearings, smoothing and polishing all parts and replacing the failure-prone crankshaft. The intense engine vibration, which causes crew fatigue and stabilisation problems, was partially caused by the use of a transverse engine block with an integral gearbox, as this prevented the use of flexible mountings.

The engine's exhaust is fitted with the same smoke generators as on the T-62, replacing two drum-like BDSh smoke dispensers mounted on the rear of early vehicles. The engine is normally started electrically, but a compressed-air system can be used in winter. The gearbox consists of five synchronised forward gears and one reverse. Steering is by a cross-drive system with a conventional clutch and brake.

The transmission is relatively effective and simple, although clutch failure is a problem. The heavy manual gear shift requires fatiguing double clutching. Newer Czech and Polish-built T-55s reportedly have hydraulic or pneumatic control boost.

Suspension and tracks

T-54/55s have a torsion-bar suspension with no support rollers and five dual road wheels per side, with a space between and first and second road wheels, an idler at the front and a drive sprocket at the rear. The first and fifth road wheels have hydraulic shock-absorbers. The tracks are wide (58cm), thick manganese steel dead track which, because they are not under tension, hang loosely and sag at the top. The track plates are held together with a single pin, although early T-54s embodied a primitive pinless system. The single-pin design has a short tread life and is quite noisy, but is 10–15% lighter than double-pin systems. All T-54/55s have a tendency to shed tracks. This has led to the retrofitting of some T-54/55/62s with live track similar to that of the T-72 and designated "RMSh".

Main armament

Capable of using the same ammunition as 100mm anti-aircraft and anti-tank guns, the D-10 series of tank guns lack a muzzle brake and have horizontal sliding-wedge breech blocks, hydraulic recoil buffers, and hydropneumatic recuperators. The D-10T on the early T-54 has no stabilisation or bore evacuator and is used with the TSh2-22 sight. The T-54A's D-10TG was stabilised in the vertical plane and had the TSh2A-22 sight. The D-10T2s on all subsequent versions is stabilised in two planes and is used with the TSh2B-22 and TSh2-32 sights.

The basic Second World War-vintage 100mm round was the BR-412 APHE (considered an AP-T round by some sources because of its small HE charge and tracer shoe). In the mid-1950s it was replaced by the BR-412B and BR-412D APHE/AP-T rounds with the DBR-2 base detonating fuze. While adequate in comparison with their foreign contemporaries, these rounds lacked penetration against more recent tanks. Though the HEAT rounds give better penetration, the Soviets have relied on kinetic-energy penetrators for their 100mm guns because of their unsophisticated fire-control equipment. The retrofitting of laser rangefinders in the late 1970s and early 1980s may have changed this. In 1968 the HVAPDS-T round was introduced, and became the main anti-tank ammunition. HEAT rounds were introduced in the 1950s. Soft targets are engaged with the OF-412 Frag-HE round. The Chinese and the Czechs have developed their own 100mm ammunition, and the Czech shells are reportedly superior to the equivalent Soviet rounds.

Optics

The T-54/55's optics are earlier versions of those used on the T-62. The commander's cupola-mounted TPK-1 binocular functions in the same way as the TKN-3 on the T-62 and the TPKU-2B of the T-55. The gunner's telescope is similar in design and use to that on the T-62. The gunner uses a TSh2-22 on the T-54 and a TSh2B-22P on the T-55. As on the T-62, there is no mechanical rangefinder or ballistic computer. The searchlights are the same L-2G and OU-3GK used on the T-62, and they are stabilised on the T-55A and possibly on modernised earlier versions. Night vision ranges are 400m for the commander's TPK-1, 800m for the gunner and 40m for the driver, using their night vision devices.

Development

There are many different T-54/55 versions. Tanks are frequently modified from one configuration to another and retrofitted with new equipment, and it is often difficult to distinguish variants.

The original T-54 appeared in 1945. Developed from the T-44 by the Morozov design bureau, the T-54 combined heavy armament with high mobility. Series production began in 1949. These early production models had the same bulbous, undercut turret as the prototype and pre-production models. Few were built, but some remained in Soviet service in the early 1970s, while others supplied to the Syrian Army were used with little success against Jordan in 1970. Starting in 1951, a revised turret was introduced; this had evolved into the standard T-54 turret by 1953.

Introduced in 1953, the basic T-54 features the half-egg turret with two cupolas and a plain gun tube. Like all T-54s (except the T-54[X]), it has a 12.7mm DShK machine gun on the right-hand cupola. When retrofitted with infra-red equipment this model is known as the T-54(M).

The T-54A first appeared in 1955 and introduced the bore evacuator on the gun tube, which appeared on all subsequent models. The gun was stabilised, though in the vertical plane only. Designated, D-10TG, the gun had power elevation in place of the manual arrangement of earlier models. The T-54A was the first Soviet tank to be designed for snorkelling, a capability later retrofitted to earlier T-54s. It also introduced improved oil filters, an electrical oil pump, bilge pumps, automatic fire extinguishers, and provision for external fuel tanks. Tanks retrofitted with infra-red equipment are designated T-54A(M).

The T-54B, which appeared in 1955, was similar to the T-54A and introduced infra-red equipment, two-plane stabilisation for the D-10TS gun, and improved snorkels.

The T-54(X) or T-54C was the transition tank (prototypes only?) between the T-54 and T-55, its only external difference from the T-54B being that the right-hand cupola and machine gun were replaced with a simple hatch.

The T-55 was introduced in 1958 and can be distinguished from the T-54 by its lack of the bell-shaped turret dome ventilator and the right-hand cupola with its machine gun, although many tanks later received the 12.7mm machine gun. A more powerful engine and improved transmission, a turret basket, and nine extra 100mm rounds increased the T-55's capabilities. The T-54's bow machine gun, fired by the driver, was dropped during T-55 production and was subsequently removed from many T-54s.

Introduced in 1960–61, the T-55A's raised hatch covers, different covering of the commander's cupola, and lack of bow machine gun indicated an internal anti-radiation lining. A PAZ NBC defence system was also fitted. The older 7.62mm SGMT co-axial machine gun was replaced by the newer PKT. The T-55A was produced in greater numbers than any other version in the series. The new machine guns and an NBC defence system, similar to that of the T-62, were retrofitted to many earlier tanks.

The T-55 remained in production until 1979, mainly for export. Distinguishing marks of the final export production T-55As were a 12.7mm DShKM machine gun by the loader's hatch, external 12.7mm ammunition boxes, an OPVT snorkel tube stowed on the turret side, and the lack of interior protective lining (retained on Soviet examples).

The T-55K command version carries three radios (R-123, R-112 and R-113, which may be replaced by more recent types), an additional generator and a telescoping 10m radio mast. It carries no hull machine gun and six fewer 100m rounds.

Combat engineer versions include the TO-55, with an ATO-200 flamethrower in place of the co-axial machine gun (but with reduced 100mm ammunition on board).

In additon to these versions, there is a plethora of minor variants and sub-types, a variety made almost limitless by equipment modification and retrofitting. This includes differences in lights, night optics, the fitting or absence of a bow splashplate, design of hatches, absence or presence of the 12.7mm gun, fuel tank arrangement, and many other items, none of which seriously affect the tank's performance.

The most important piece of new equipment fitted to the T-54/55 appears to be a laser rangefinder. First seen in 1977–78, these large, box-like structures mounted above the gun tube increase gun accuracy. In the 1980s T-55s in Afghanistan have been fitted with extra armour, including fabric skirts over the suspension, as mounted on the T-72s, and appliqué armour on the turret front and ring and belly.

Specialised versions include the BTS-1, 2, 3 and 4 series, designated T-54-T by NATO, the standard Soviet armoured recovery vehicle. It mounts a 1,000kg-capacity jib crane, a loading platform (but no winch) and a rear spade for heavy lifting on a T-54 chassis, and weighs 32,000kg. The MTU-54/55, M-1967 and MT-55 bridge-layers are all based on the T-54/55 chassis. KMT-4 and -5 mine rollers, the BTU dozer blade and the STU snowplough are easily mounted on the T-54/55.

BTS-2 armoured recovery vehicle extracting a T-62 from soft ground.

Identical to the standard T-54, this Chinese-made T-59 with a DShKM machine gun was captured by the South Vietnamese Army in 1972. (*US Air Force*)

Foreign production

Czech and Polish production started in the late 1950s. At first they duplicated the Soviet originals, but the rear deck design and storage box arrangements were soon modified. Czech-built machines have three curved plates mounted on each side of the hull to reduce the number of thrown tracks, and the Soviets and other nations are reportedly adopting this modification. All Polish T-55s mount a 12.7mm machine gun in the same way as on T-54s. Polish and Czech tanks exhibit a standard of workmanship superior to that of Soviet-built examples. Polish-built tanks are used by East Germany and Czech-built versions have been widely exported.

The T-59 is a simplified Chinese copy of the basic T-54. It retains all the outdated elements of that tank: no gun stabilisation, no snorkelling capability, no automatic fire extinguisher, no APDS rounds, and the commander cannot traverse the turret. Reliability and workmanship were reportedly even worse than on Soviet tanks. The T-62 Chinese light tank is based on scaled-down versions of the T-59. An improved version of the Type 59, the Type 69, had supplanted it in production by the mid-1980s. It is a popular export tank, being cheaper than the T-55.

Many foreign users of T-54/55s have considered updating them with Western technology. The provision of improved systems, components and rebuilds for exported T-54/55s became a growth industry in the West in the late 1970s and 1980s. Romanian T-55s were seen in 1979 with armoured side skirts, a new 12.7mm anti-aircraft machine gun, and two additional rear cooling flaps for the engine. Bulgarian T-55s also have been fitted with the side skirts. T-1967s or T1-67s are T-54/55s captured by Israel in 1967 and modified with a US-built Continental diesel engine, an L7A1 gun and Israeli machine guns. New radios, rangefinders, fire-control equipment, optics, electrical systems, night-fighting equipment and air-conditioning were also fitted. The suspension was improved and the turret was internally rearranged to reduce vulnerability and increase crew efficiency. Despite these modifications the Israelis still do not consider the tank as effective as the M48/60 or Centurion, since many of the design's original flaws, including its cramped interior, remain. A brigade of T-1967s under Col Gonen fought in Sinai in the 1973 war. The Israelis have continued to update these tanks, re-designating them "Mark S" and fitting laser rangefinders. While being produced primarily for export, they are also reported to have been used in action by the Israelis in 1982.

Weapons effectiveness and combat usage

Although the 100mm gun has been in service for over 35 years and the US Army has had test examples for years, accuracy data on the D-10 remain sparse and general, and hit probability estimates must be treated as being even more approximate than usual.

Soviet "textbook" estimates of the 100mm gun's accuracy are much higher. Theoretically, a gun using a BR-412B APHE round against a halted enemy tank 2.7m high and 3.6m long should have a 77% chance of hitting its target at 1,800m range. Actual accuracy would doubtless be much less in combat conditions. Maximum indirect-fire range requires a 28° slope.

Ammunition	Range (metres)				
	500	1,000	1,500	2,000	2,500
BR-412 APC-T	90%	50%	33%	8%	4%
BK-5M HEAT	84%	43%	25%	2%	–

Armour penetration data (mm at 0° obliquity) are better known:

Ammunition	Range (metres)			
	500	1,000	1,500	2,000
BR-412 APC-T	155	135	117	100
BM-6 HVAPDS	–	264	–	237
BK-5M HEAT	380mm at any range			
BR-412B APC-T	–	171	–	146
BR-412D APC-T	–	175	–	157

The probability of killing an M60A1 with a 100mm shell is about 50%, although this depends heavily on where the target tank is hit.

The T-54/55 has probably seen more combat than any other post-war tank. Soviet T-54/55s invaded Hungary in 1956 and were involved in at least one tank battle against Hungarian Czech-built T-34/85s. The Soviet T-54/55s that rolled into Czechoslovakia in 1968 were marked with white crosses for recognition in case the Czechs resisted. A few were lost to Molotov cocktails. Soviet T-54/55s have also clashed with Chinese forces.

The T-54/55 was the standard Arab main battle tank in both the 1967 and 1973 wars. In 1970 Syrian T-54s were trounced by Jordanian Centurions. In the Sudan T-54s were used in the long and bloody civil war. T-54/55s fought each other along the Trig Capuzzo and Hellfire Pass in the 1977 Egyptian-Libyan fighting. The Israelis used T-1967s in the 1973 war. The T-54/55 was a standard Indian tank in the 1971 war, when it was largely opposed by Pakistani T-59s. North Vietnamese T-54As were introduced into combat in 1972. Although defeated at the siege of An Loc, due largely to the failure of their supporting infantry, they were heavily engaged in the I and II Corps area. Although they suffered heavy losses to air strikes and could not always defeat South Vietnamese armour, they were extremely effective. Rumours of these big tanks panicked South Vietnamese troops throughout II Corps area in the 1972 offensive, and many of the North Vietnamese drives in I Corps area were spearheaded by T-54As, which served alongside T-59s. Using the lessons in armoured combat learned in the Laos invasion, the North Vietnamese emphasised tanks in their successful 1975 offensive, and later in their drive into Cambodia. Doubtless Vietnamese T-54As met Chinese T-59s in the 1979 fighting. Over 250 Libyan T-55s were destroyed or captured by Chadian forces in 1987 alone.

In Africa T-54/55s were standard Cuban and Angolan equipment in the Angola fighting. In the Ogaden war both sides were equipped with them. Tanzanian T-59s spearheaded the 1979 drive into Uganda, possibly opposed by Ugandan T-54s. In the 1980s T-54/55s have seen action throughout the world: in Afghanistan, in Lebanon (where T-54/55s have equipped Amal, PLO and some Druze forces, and the South Lebanon Army uses T-1967s, which seem to have been relegated by the Israelis to second-line reserve units since 1982), Angola (Cuban and MPLA forces), and Rhodesia/Zimbabwe (the former government had 20 Polish-built T-55s).

While their mobility and low silhouette are praised, the mechanical problems and poor crew accommodation and fighting ability are frequently criticised by all nations using these tanks. The armour and the gun seem to have elicited neither praise nor blame. The T-59 is not popular, especially amongst the Pakistanis, as it has all the drawbacks of the T-54/55. Its crude workmanship and lack of sophistication make it even more deficient, especially after 1968 when the Soviets introduced and exported the BM-6 HVAPDS round, which was used by the Arabs in 1973 and the Indians in 1971. In that war, however, T-59s used APHE rounds.

In its dual role as the low-cost end of the Soviet tank force and approved export design, the T-54/55 series is being replaced by the T-72 and, to an extent, by T-62s displaced by modernisation.

Tactical employment

The T-54 and T-55 are still standard Soviet main battle tanks. They are still found in many Soviet units, especially the tank units in Category II and III motorised rifle units, and in at least some Category II (or I) tank divisions. They are also used as training tanks by many units which have later tanks in storage. The independent tank battalions of some motorised rifle divisions in GSFG were reported to be still using T-55s in the early 1980s, although their divisional tank regiments had T-64s. These T-55s were apparently equipped with extensive amounts of mine-clearing equipment. Other front-line operators include North Korea and the Warsaw-Pact.

Engagement sequence and **Vulnerabilities and countermeasures**

See T-62.

T-62As of the US Army. The tank in the foreground has its 12.7mm machine gun dismounted to protect it from dust when travelling, a common Soviet practice. (*US Army*)

T-62 main battle tank

Combat weight 40 tonnes **Length (gun forward)** 9.335m **Length (gun rear)** 9.068m **Height (without AAMG)** 2.395m **Width (overall)** 3.3m **Track** 2.64m **Clearance** 0.425m **Track width** 0.58m **Ground contact** 4.15m **Ground pressure** 0.83kg/cm² **Max road speed** 50km/h **Fuel capacity (internal)** 675 litres **Fuel capacity (external)** 285 litres **Fuel capacity (jettisonable rear drums)** 400 litres **Oil capacity (max)** 167 litres **Fuel consumption (paved roads)** 1.9-2.1 litres/km **Fuel consumption (unpaved roads)** 3.0–3.3 litres/km **Oil consumption** 1.5–3.0 litres/h **Range (paved road)** 450km (without extra tanks), 650km (with extra tanks) **Range (unpaved road)** 320km (without extra tanks), 450km (with extra tanks) **Travel speeds (1,800 rpm)** 14.5km/h (1st gear), 20km/h (2nd gear), 29km/h (3rd gear), 45.5km/h (4th gear), 50km/h (5th gear) 7km/h (reverse) **Fording** 1.4m **Snorkelling** 5.5m **Gradient** 38° **Generator/alternator** 1.5kW **Turning circle (at 10–15km/h)** 8.8m **Vertical obstacle** 0.8m **Trench** 2.85m **Power/weight ratio** 19.17hp/tonne **Engine** V-55V V-12 diesel, water-cooled, 580hp @ 2,000rpm, 38,800cm³ **Transmission** Mechanical synchromesh, 5 forward, 1 reverse gears **Steering** 2-stage planetary clutch and brake **Gun** U-5TS (2A20) 115mm smoothbore **Calibre length** 55cal **Rate of fire (theoretical)** 7rpm **Rate of fire (actual)** 4rpm **Max range** 4,000m (HVAPFSDS), 3,700m (HEAT), 4,800m (Frag-HE 18), 3,600m (Frag-HE 11) **Effective range** 1,500m (HVAPFSDS), 1,200m (HEAT), 1,500–2,000m (HE) **Ammunition types** BR-5 HVAPFSDS, BK-4M HEAT, OF-18 Frag-HE, OF-11 Frag-HE **Muzzle velocity** 1,615+m/sec (HVAPFSDS), 1,000m/sec (HEAT), 780m/sec (OF-11 Frag-HE), 750m/sec (F-18 Frag-HE) **Shell weights (projectile/round)** 6.8/22.5kg (HVAPFSDS), 11.8/26.2kg (HEAT), 14.9/28.1kg (OF-11 Frag-HE), 17.7/30.6kg (OF-18 Frag-HE) **Ammunition load** 40 rounds = 14 HVAPFSDS, 7 HEAT, 19 Frag-HE **Co-axial MG** 7.62mm PKT **AA MG** 12.7mm DShKM (when fitted) **7.62mm ammunition** 2,500 rounds **12.7mm ammunition** 500 rounds **Main gun elevation** −4°/+17° **Traverse** 360° **Turret mechanism** electro-hydraulic **Armour** 100mm @ 60° (230mm basis) (hull front), 170mm rounded (200mm basis) (turret front), 80mm @ 0° (80mm basis) (hull side), 20mm @ 0° (20mm basis) (lower hull sides), 80mm rounded (120mm basis) (turret side), 60mm @ 0° (60mm basis) (hull rear), 40mm rounded (60mm basis) (turret rear), 20–30mm rounded (30mm basis) (turret top), 30mm horizontal (30mm basis) (hull top), 20mm horizontal (20mm basis) (hull floor) **Crew** 4 **Radio** R-123, plus R-112 in company command tanks

While production ceased in the Soviet Union in about 1975 and in Czechoslovakia around 1978, the T-62 is still a standard main battle tank. Though displaced by the T-64 and T-80 as the high-capability tank, it will remain in service to the 1990s. Entering production in 1961–62, it predominated in Soviet armoured units throughout the 1970s and saw action in the 1973 Middle East War.

The T-62 is basically an improved, upgunned T-55. Its hull is longer and wider, the turret is lower and more rounded, the road wheels are evenly spaced, and the commander's cupola is on the left, an integral part of the turret and not bolted on as it is on the T-55. The T-62 has no loader's cupola, just a hinged hatch. The tube of the

115mm U-5TS with its bore evacuator is longer and thicker than that of the 100mm D-10. Dust "rooster tails" behind advancing T-62s, caused by their engine blower, are another recognition feature.

The Israelis, having faced T-62s in 1973 and 1982, criticised its poor human engineering, the inaccuracy of the U-5TS at long range, and the lack of gun depression. They approved of its light weight and considered its protection, coupled with a low silhouette, adequate. The U-5TS is considered to be highly accurate, especially at 1,500m or less range. General "Bren" Adan, the Israeli tank commander, considers it better than the standard NATO L7A1 105mm tank gun.

Hull and turret

The T-62's hull is of all-welded, rolled steel construction, and the turret is a one-piece casting. Most Soviet tank armour is standard homogenous steel. For thicknesses less than 50mm, the Soviets use chrome-manganese-silicon steels. Heat-treated to high hardness levels, they tend to exhibit brittle failure after impact. The hull is divided by bulkheads into crew and engine and power-train compartments. There is an escape hatch in the hull floor behind the driver's seat. The driver's compartment in the left front of the hull contains the driving controls and instruments, including steering laterals, a clutch pedal, brake/accelerator, manual throttle handle, fuel tank selector switch, master switch, and many gauges and indicators. The V-55V engine is basically an improved version of the V-55, and shares its characteristics. The power-train compartment contains the master clutch, the five forward, one reverse-gear manual transmission, steering clutch and final drive. Clutch operation is air-assisted reducing the effort in shifting gears and clutch wear, though both are considerable. Clutch failure causes 40% of all T-62 breakdowns that are not repairable on the spot. The clutch is basically the conventional steel-to-steel multidisc design used in earlier tanks. Before the air-assist feature was added in late-production T-55s, driver abuse created even more failures. In addition, the T-62 does not handle well at speeds of 20–25mph (32–40km/h); it is described as being "sloppy" at these speeds.

There is little ventilation in the driver's compartment, and driving the T-62 (or T-54/55) is very fatiguing, using

A platoon of Soviet T-62s.

the two laterals for steering and double clutching for the five forward and one reverse gears. US Army tests have found that in a moderately warm climate, heat build-up and fatigue can cause driver performance to deteriorate after 30–45 min. The effect of desert conditions can best be imagined. If the driver's hatch is left open, a safety switch prevents the turret from rotating. The cramped conditions, the high level of vibration and the springy ride caused by the suspension soon degrade the performance of even the small and hardy Soviet tankmen. The human engineering of the T-62, like that of the T-54/55, is very bad, being exemplified by the loader having to use his left hand in loading the gun and by the driver's lack of ventilation. Throughout Soviet tanks, all the many switches and projections are placed so that the crew cannot avoid hitting against them, especially when the tank is moving at high speed, adding cuts and bruises to their problems. Spinal and kidney damage is also frequent. In the 1973 War numbers of Arab tankmen were affected by these conditions, and some were asphyxiated or went into shock.

A fire-extinguisher system can be triggered manually or automatically by one of eight heat sensors. However, the fire extinguisher's ethylene bromide gas is highly poisonous; if the extinguisher discharges, the crew must bail out at once. Any weapon that can trigger the extinguisher system by creating heat – such as a Molotov cocktail on the engine decking – can knock out a T-62.

Suspension and tracks

The T-62 has a torsion-bar Christie-type suspension with shock-absorbers on the first and last of the five dual-rubber-tyre road wheels on each side, along with a compensating idler and a rear drive sprocket. The dead track is wide, thick and made of relatively wear-resistant cast manganese steel. The track pins are not secured at their outer ends, and are free to travel towards the hull. The pin hammer, a raised metal projection on the hull forward of the sprocket, drives the pin back in each time it passes. The centre guides of the tracks ride between the dual road wheels. Despite all these safeguards, the T-62 still frequently throws tracks. Vibration at high speed, quick turns, and going into reverse all cause track throws, and mud caking around components compounds the problem. Although the T-62 has been widely reported to be prone to throwing tracks during high-speed turns, tests on US Army T-62s, which included hundreds of such manoeuvres on hard and soft surfaces with varying track tensions, show that these reports were not valid. Track pitch is 175mm, and there are 74 shoes per track. It is 40mm thick and of non-magnetic Hadfield steel, which work-hardens and has good cold-weather characteristics.

Soviet dead tank track is simple (the track blocks pivot around a single metal pin) and inexpensive, but loud and easily worn out due to the metal-to-metal contact of track blocks without the rubber bushing of US-style live tank track. Track life on paved roads is estimated at approximately 2,500km, after which it may be overhauled and used for another 2,500km. This applies to all Soviet tracked vehicles, not just to T-62s. The new RMSh track lasts longer.

Development

The T-62A appeared around 1968 and differed from the standard T-62 in having the loader's hatch assembly redesigned to accommodate a 12.7mm DShKM machine gun, and modified rear decking; it is reported to have been designated T-62M by the Soviets. Starting in the late 1970s, some T-54/55/62s were retrofitted with live track and a modified drive sprocket, as on the T-72. The T-62K is a command tank version, used by battalion and higher-level tank commanders. It has reduced (32 round) ammunition storage, an auxiliary generator, additional radios and a TNA-3 land navigation system. The T-62-T is an armoured recovery vehicle version. It is a conversion not of the basic T-62 but of the IT-130 tank destroyer. Also known as the M-1977 ARV, it lacks a crane. A reported ATGM-armed version is designated IT-1.

Soviet T-62s and T-55s in Afghanistan in 1985–87 were fitted with three extra pieces of armour, one on the glacis and two curved bars running around the turret from the 1 o'clock to 3 o'clock and 9 o'clock to 11 o'clock positions. These are apparently issue items rather than field improvisations, and are probably made of 100–150mm-thick steel. Side skirt armour and extra belly armour were also applied.

The T-66 or T-67 was a T-62 development that did not see widespread production. It may have had a Sagger

A T-62-T (M-1977) armoured recovery vehicle in Moscow in 1977. The marks on its glacis plate suggest that it was converted from a self-propelled 125mm or 130mm assault gun mount. (*US Army*).

ATGM over the gun tube or other elements making it the "missing link" between the T-62 and T-64/72 series.

Armament

The T-62's 115mm smooth-bore U-5TS (2A20) gun fires the BR-5 HVAPFSDS, BK-4M HEAT, and OF-18 and OF-11 Frag-HE rounds. The BR-5's steel penetrator uses fins, as the sabot falls away, to give it stability in the absence of the spin stabilisation of projectiles from rifled guns. The BR-5 has a muzzle velocity of 1,615m/sec, more than four times the speed of sound, giving it a flat trajectory but also making it too fast for the eye to follow in flight; this makes it difficult to correct aim. The penetrator's fins have a tendency to "weather-vane" in a crosswind at long range. The smooth-bore gun, in addition to having high muzzle velocity, weighs less and has a longer barrel life and less recoil than rifled weapons. The widespread retrofitting of laser rangefinders to the T-62 has made increased long-range accuracy possible, although it remains unlikely to have the sophisticated environmental sensors and fire-control computer of comparable Western tanks.

The U-5TS is optimised for short-range accuracy, as most tank actions take place at short range and Soviet gunners would probably not be proficient enough to take advantage of long-range accuracy. Defending tanks normally hold their fire until 1,500m range, and long-range targets are engaged by selected gunners or, more often, platoon volleys. A basic stadia reticle is therefore adequate for rangefinding, while aiming is through a graduated telescope. The provision of the same combination laser rangefinder and target designator used on T-54/55s and its associated ballistic computer is now increasing the U-5TS's accuracy, especially at long range. The T-62's improved stabilisation also increases armament efficiency, but the Soviets still fire from the short halt rather than on the move. Despite its two types of Frag-HE round, the U-5TS is intended to destroy tanks, and unarmoured targets (such as ATGM teams) will be left to accompanying SO-122s whenever possible.

Despite its technical excellence, the U-5TS has a number of drawbacks. The turret tends to fill with carbon monoxide in action, despite the provision of a bore evacuator to remove fumes. Another problem, apparently not infrequent, occurs when the automatic cartridge ejector does not align properly with the ejection port, which often happens after high-speed vibration has disturbed the mounting. The spent brass then rebounds off the turret wall and ricochets at high speed around the cramped turret interior. The tank commander has been provided with a shield against being struck; the other crew members are not so fortunate. Although the official rate of fire of the U-5TS is seven rounds a minute, US Army tests show that the actual maximum rate of fire, aiming from a standstill, is four rounds per minute. Ammunition accessibility also affects rate of fire. Owing to safety and space constraints, only two rounds are stored in the turret ready rack. Single additional rounds are located near the gunner's and loader's feet, and the remaining 36 rounds are stored in the hull.

A flamethrower version of the T-62 is in service, possibly with a system similar to that of the TO-55 flamethrower tank.

In addition to the appliqué armour on the hull and turret front and armoured fabric skirts appearing on examples in GSFG and Afghanistan, the T-62 now has Western-style six-barrelled smoke mortars – similar to those of the T-72 – mounted on the turret sides. There has been concern in the West that these mortars could also eject flares that would jam the trackers of ATGMs such as TOW and Milan.

There were repeated reports of ATGM-armed T-62s in the 1970s, with missiles mounted either over the gun tube or in canisters on the turret rear or rear decking. In addition to providing long-range firepower, these tanks may also have had an anti-helicopter role. It is likely that only a few tanks were so fitted.

Optics

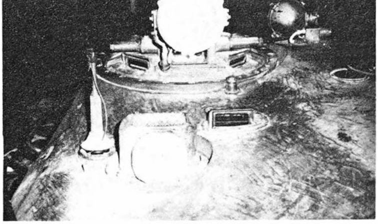
The commander has five, the driver two, and the loader and gunner one each of the standard 1 × -power TNP-165 vision block replaceable from the inside in case of damage.

The commander uses a TKN-3 binocular vision device, as fitted on the BMP. Mounted in the cupola, it rotates for all-around search, rangefinding (using the range stadia) and gunlaying, using turret traverse controls. It cannot be used for rangefinding at night – the gunner must perform that function – but it can be used with the OU-3GK commander's searchlight, which is mounted co-axially with it and can give white or infra-red light at a range of up to 400m. The TKN-3's night range is 800m at 4.2 × and an 8° field of view, compared to 5 × and a 10° field of view by day.

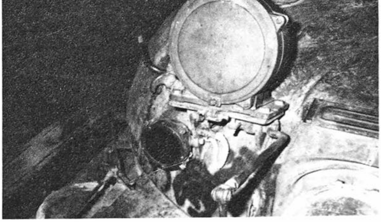
The gunner's TSh2B-41u has a large wrap-round headrest for use when the tank is moving. It includes a stadiametric rangefinder and five elevation reticles. Daytime magnification is 7 × with a 9° field of vision, while at night it has 3.5 × magnification and an 18° field of vision. A 5.5 × TPN-1-41-11 infra-red monocular periscope with a 6° field of vision is used with the main searchlight for night gunnery, and allows firing up to 800m. It is being replaced with the 900m-range IPN-22MI. These optical systems, like many Soviet night optics, can detect enemy infra-red emissions.

The main 200-watt L-2G searchlight, mounted to the right of the main gun, can emit either white or infra-red light by means of filters, and has an infra-red range of 800m. It is currently being replaced with a newer model.

The loader's MK-4S periscope, fixed in the turret roof,



T-62 tank commander's OU-3GK searchlight, with cover fitted.



L-2G searchlight with a protective lens cover, mounted on a T-62.

has a 25° field of vision ahead and 16° to the rear. The driver has a TVN-2 or -3 active infra-red driving periscope with a range of 40–60m.

Some Soviet T-62s, including a number in Afghanistan, have a box-like device mounted in place of the L-2G infra-red searchlight. This is probably an improved night optics system that may in the future be retrofitted to T-64/72/80-series tanks; it has also been suggested that it may be a battlefield surveillance radar. Laser rangefinders are mounted in the same way as on the T-55.

Snorkelling

All Soviet main battle tanks can use either the thin OPVT combat snorkel with attached periscope that is stowed on the tank, or a thick training snorkel that doubles as an escape trunk. Complete preparation for snorkelling can take from 90min to eight hours, and includes packing the turret ring with grease to ensure watertightness. Final preparation, including erecting the snorkel, is performed 2,000–5,000m from the river and takes 15–20min. The second echelon of an attacking tank unit will be prepared for snorkelling when a river crossing is anticipated, and will pass through the first echelon in order to cross. Tanks cannot fight when prepared for snorkelling, as the barrel is sealed and the turret locked. On emerging, the gun may be

T-62s snorkelling. The T-62's main gun is nicknamed *Molot* ("Hammer"). *(Chris Foss)*

fired and the snorkel jettisoned, but the turret cannot traverse until the grease is removed. The Soviets will ferry tanks or use bridges whenever possible. It is often difficult to find a suitable snorkel site, as the technique requires a solid, flat bottom no deeper than 5.5m and a current of less than 3m/sec. A bilge pump with a capacity of 100litres/min is fitted, and a prominent splashboard in front of the glacis prevents water rushing up the hull. Tanks snorkel in single file at 2km/h, so snorkelling attacks are hardly practical. Tanks can snorkel for a maximum of 1,000m.

NBC protection

The T-62's PAZ NBC defence system is activated either manually or automatically when the RBZ-1m gamma sensor detects the initial pulse of radiation that precedes a nuclear blast, and automatically shuts all openings to the tank and cuts off the engine to alert the crew. The T-62 has a protective anti-radiation lining; hermetic sealing of the combat and driver's compartments protects the crew from shock waves, and air purification and slight overpressure protect against radioactive dust by passing incoming air through a centrifugal blower and dust separator. External rubber parts are protected with asbestos against the heat of a nuclear blast. However, the T-62 is not completely airtight unless it receives the full eight-hour waterproofing treatment, and using the gun would break the seal. The filter has no protection against airborne chemical or biological contaminants, so indivial NBC suits will have to be worn. Despite this, the Soviets believe that the NBC protection of their tanks will allow them to cross radioactive areas and exploit the use of NBC weapons. Exported T-62s have the PAZ system removed, but they retain the internal plastic and lead anti-radiation lining. Late-model Soviet T-62s have an NBC filter.

Smoke

The T-62 is fitted with standard Soviet thermal smoke-generating equipment. A switch on the driver's panel injects raw diesel fuel onto the manifold. This creates a dense, white, opaque smoke screen 250–400m long that lasts for two to four minutes, consuming ten litres of fuel per minute for up to ten minutes non-stop; any longer would flood the engine. Tanks moving at up to 30km/h can use this to screen following troops, or a stationary tank can use it to fake its destruction. The commander of the Israeli 188th Armoured Brigade was killed in 1973 by a T-62 that apparently used this stratagem.

Cold-weather operations

Soviet tank heaters are efficient, and reportedly can be used while buttoned up. Soviet tank engines must be warmed up for at least ten minutes in cold weather. If cold inhibits a battery start, a compressed-air system can be used, so Soviet tanks operating in cold weather do not have to break noise discipline by warming up their engines in the middle of the night, unlike US M60s. A pre-heater is provided to prevent the diesel fuel from solidifying at low temperatures. Soviet tanks can move over ice 0.72m or more thick, and operate normally in snow 0.5m or less deep.

Land navigation systems

The T-62K's TNA-3 system, introduced in 1973, includes a gyrocompass, one or two compass indicators, a latitude correction device, an odometer, a power converter and a calculator.

The gyrocompass and indicators (one each for the driver and commander) give the tank's azimuth corrected for latitude. The odometer gives distance travelled in metres and the calculator displays the grid co-ordinates, calculated from those entered as the starting point, thus allowing continuous en route readout of the tank's location. It can also give distance and azimuth to a predetermined objective. Yielding 90% accuracy and giving locations to the nearest ten metres, the TNA-3 must be reset every 90min, although a correction setting can adjust for terrain. Warm-up time is 15min, and moving the vehicle during that time will damage the system. The TNA-3 is a simple, rugged system that requires little attention. Standard T-62s use the GPK-59 gyrocompass, chiefly for snorkelling, in place of the earlier GPK-58 also mounted in T-55s. The GPK-48 was accurate for only 15min at a time, while the GPK-59 is accurate for 90min. Both have a warm-up time, but the only datum they require is initial heading.

Weapons effectiveness and combat usage

The US Army obtained many T-62s from Israel after the 1973 war and so has been able to test its effectiveness, both theoretically and in the field. According to these tests and studies, the probability of a stationary T-62 hitting an M60A1-size target is shown in the table overleaf.

Moving targets are assumed to be at 24km/h at a 30° angle to the T-62. Second rounds on target assume a first-round hit. If an M60A1 is hit, a BR-5 round has a 71% kill probability and a BK-4M has a 75% kill probability. Figures using a laser rangefinder are unofficial estimates based on Western equipment.

Armour penetration (BR-5 HVAPFSDS, 0° obliquity):

Range (m)	500	1,000	1,500	2,000	2,500	3,000
Armour (mm)	350	300	285	270	245	215

Ammunition	Shot at target	Range finder	Target	Range (metres) 500	1,000	1,500	2,000	2,500	3,000
BR-5 HVAPFSDS	1st	stadia	static	98%	79%	50%	27%	14%	8%
BR-5 HVAPFSDS	2nd	stadia	static	98%	84%	66%	51%	40%	32%
BR-5 HVAPFSDS	1st	laser	static	98%	86%	60%	43%	20%	10%
BR-5 HVAPFSDS	1st	stadia	moving	94%	75%	33%	19%	8%	nil
BK-4M HEAT	1st	stadia	static	89%	69%	33%	11%	3%	3%
BK-4M HEAT	1st	stadia	moving	75%	30%	5%	nil	nil	nil

Uparmoured T-62Es, the lead tank mounting a KMT-4 mine plough and attachments for a KMT-5 mine roller. The added "horseshoe" steel armour and fabric armour skirts are intended primarily to defeat RPG-7s. Just visible on the second tank is a form of sloping appliqué armour attached to the belly to deflect the blast of anti-tank mines. The Afghan Army had T-62s before the Soviet invasion; most have since been lost and replaced with T-55s. *(US Department of Defence)*

Armour penetration (BK-4M HEAT): 432mm regardless of range.
All figures assume steel armour at 0° obliquity.

U-5TS accuracy reportedly deteriorates in sustained combat due either to the effects of a hot barrel on the shells or fouling due to incomplete combustion in the chamber.

The T-62 cannot fire as quickly as many comparable Western tanks. This is not compensated for by its accuracy or armour penetration. Even in the 1973 War, fought in vast open spaces, the average engagement range was between 300 and 800m. The mean range of engagement varies from 500m in Southern Germany to 700m in North-west Europe and 1,100m in North African-type desert. At these ranges any modern main battle tank can hit and knock out any other modern battle tank. The advantage belongs to the tank which fires first, much as it did throughout the Second World War. Many tank battles, like Western gunfights, are basically "quick draw" situations. Despite this, the Israelis are reportedly satisfied with the U-5TS and consider it capable of first-round kills at up to 4,000m range.

Both Egypt and Syria used T-62s in 1973, when they constituted a higher percentage of Syrian tank strength than Egyptian. Syrian T-62s fared little better than T-54/55s. Although they inflicted heavy losses on the Israeli 188th Armoured Brigade, they shared the fate of the rest of the Syrian armour in the "Valley of Tears". The Israelis obtained most of the T-62s used by themselves and by the US from tanks knocked out or abandoned at this stage of the fighting. Later in the campaign, Syrian T-62s were prominent in the defence of Ssassa against Israeli armour. The Egyptians used their T-62s in independent armoured brigades, although some served in armoured divisions. The T-62-equipped 25th Armoured Brigade, hurrying north to the Battle of the Chinese Farm, was annihilated in an Israeli ambush. Other Arab units also failed to use the tank to its full potential. Soviet T-62s went into Czechoslovakia in 1968 and have been in border clashes with the Chinese, who have captured at least two knocked-out T-62s. Soviet T-62s have been in action in Afghanistan since 1981–82.

Libyan T-62s have not been committed to action in Chad, but fought Chadian forces in Libya in 1987.

Tactical employment

The T-62 equips tank units in tank and motorised rifle divisions in the Soviet Union and Afghanistan. It is also believed to be used for training by T-64 and T-80-equipped units in East Germany and Hungary. Modified T-62s with improved armour and smoke mortars were seen in East Germany in the mid-1980s, and while the divisional tank units in GSFG were equipped with T-64s and T-80s in 1986, the T-62 remained in service. The T-62 has filtered down to lower-readiness units as more advanced tanks have entered service.

Engagement sequence

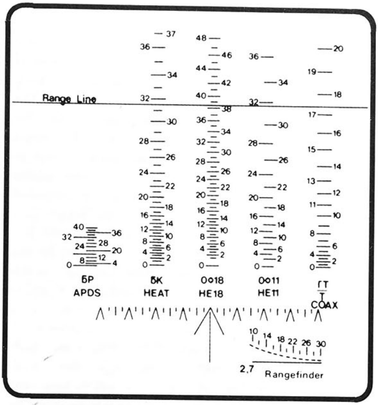
The engagement sequence for the T-62 is similar to that used on all gun-armed Soviet AFV's without laser rangefinders. The commander searches for targets with his TKN-3 target designator sight, rotating the cupola, while the gunner uses his rotating MK-4 periscope to search from the other side of the tank. The driver and loader watch to the front. Anyone spotting a target gives its bearing over the intercom, and the commander or gunner can then traverse the turret in that direction, although there must be a round in the breech and the safety must be depressed to the "fire" position for the turret power traverse to be used. If the tank commander is going to traverse the turret, he announces "override, right" (or left) over the intercom and depresses the override button on the TKN-3's left handgrip until the gunner announces "identified", when the traverse brings the target into his TSh2B-41u sight picture. Although the tank commander can traverse the gun, he cannot fire or elevate it.

The tank commander normally determines the range. If the target is approximately 2.7m high (about the height of an M60A1 tank), he can use the rangefinding stadia on the TKN-3, simply seeing which of the graticules – numbered with the range in hundreds of metres – and the baseline bracket the target. If the target's height is substantially different from 2.7m (such as a hull-down tank), the commander must use the 4-mil azimuth scale and simple formula to determine range. If the tank commander cannot determine the range, the gunner will use the TSh2B-41u telescope's stadia rangefinder or the lateral lead and azimuth lines and the rangefinding formula.

If the tank is equipped with a laser rangefinder, it can be used by either the commander or the gunner. The result is a range readout, the accuracy of which is uncertain. The range may be in either digital or analogue form, and may have to be manually set on the gun, as with a range determined with an optical rangefinder. Intervening vegetation and dust can fool a laser rangefinder.

Once the range has been determined the commander gives the firing command, including ammunition to be fired, target type, range and direction. The gunner then elevates the gun. A black horizontal range line on the TSh2B-41u indicates the elevation, and this is adjusted to coincide with the correct range line – also numbered in hundreds of metres – on one of the five range scales for five different ammunition types. Because of the flat trajectory of the BR-5 HVAPFSDS round, he will not have to set elevation for this shell at ranges of under 1,500m. If the gun is not yet loaded, the loader is then ordered to load the proper round and depress the safety to the "fire" position. The gunner will then track the target using his power controls, either centring the aiming point on a stationary target or using the sight's lead lines to lead a moving target. He then selects the main gun switch, which also turns on

RETICLE OF THE TSh2B-4lu TELESCOPE



Reticle of the TSh2B-41u telescope. This is the scope picture the T-62's gunner sees. The English-language legends do not of course appear on the originals, but the Russian-language legends and the numerals all do. *(US Army)*

the automatic shell extraction, and announces "Ready."

The tank commander orders "Fire." The gunner presses the electrical trigger on the right handgrip of his controls or, alternatively, the manual triggers on the elevation handcrank or the gun itself. The gun fires and, upon recoil, the breech opens and ejects the spent shell casing into the automatic ejection tray, where it is seized by grippers. The ejection tray elevates, the ejection port hatch in the rear of the turret opens, and the ejector propels the casing at great speed through the open port, which then closes. Meanwhile, the gun has automatically gone to between two and five degrees elevation to facilitate reloading. The loader then reaches his left hand behind him for a shell in the ready ammunition rack, guides it halfway into the breech and then seats it with a vigorous shove, snatching his hand away from the rapidly closing horizontal sliding breech. Throughout the loading process the gun is elevated and all power operation is automatically cut off until the loader has chambered the round and depressed the safety to "fire." This means that the gunner cannot traverse the gun to follow a moving target while reloading. After the gunner depresses the safety, the gun will, if the stabilisers are engaged, automatically return to its previous firing position.

Vulnerabilities and countermeasures

T-62s and T-54/55s have driver, commander and gunner all lined up on the left side of the tank, and a single penetration can hit them all. Internal arrangement of shells and fuel and the absence of protection for either leads to many brew-ups even after non-penetrating hits. The main internal fuel tank is forward of the engine, while other fuel tanks – one in the T-54/55 and two in the T-62 – are in the right front of the hull, with ammunition storage in sleeves going into the fuel tank (i.e., ammunition surrounded by fuel!). Two large, jettisonable 200-litre fuel tanks are mounted on all Soviet tanks after the T-54A. Fuel panniers are also mounted externally on the fenders. The T-62 mounts three 95-litre panniers on the right fender, along with a small oil tank. This fuel tank arrangement is not however as disastrous as it might seem. Soviet diesel fuel – the equivalent of US diesel No 2 – has a high flashpoint.

US Army tests show that white phosphorus shells will not detonate externally stored Soviet diesel fuel. Nevertheless, photos from all over the world of burnt-out hulks of Soviet tanks testify to their vulnerability. The internal finish and component arrangement of Soviet tanks both promote spalling and make them vulnerable to its effects. The US Air Force estimates that to kill a Soviet MBT a 1,000lb bomb must impact within 6m, a 500-pounder within 1.9m, although it is thought that the damage would immobilise the tank if the bombs struck twice those distances away.

Above: T-64Bs parade in Moscow. While they do not have the guidance box for the AT-8 Songster mounted, it would fit on the L-shaped mount flush with the turret top by the commander's hatch, above the Guards insignia.

Left: T-72M with 12 smoke mortars and early-style turret. Accuracy of the 125mm gun is limited by poor quality control of the propellant, resulting in uneven burn rates, and problems with the fire-control system.

T-64/T-72/T-80/T-80 Follow-on series of main battle tanks

	T-64	T-72M	T-80
Combat weight	38 tonnes	41 tonnes	42 tonnes
Length	9.1m	9.24m	9.98m
Height	2.3m	2.3m	2.3m
Width	3.38m	3.6m	3.6m
Clearance	0.43m	0.43m	0.43m
Track width	0.58m	0.58m	0.58m
Ground pressure	$0.77kg/cm^2$	$0.83kg/cm^2$	$0.85kg/cm^2$
Max road speed	70km/h	60km/h	70km/h
Fuel capacity	1,000 litres	1,190 litres	1,000 + litres
Fuel, external	400 litres	400 litres	400 + litres
Range, integral fuel	450km	480km	c400km
Trench	2.7m	2.8m	2.7m
Vertical obstacle	0.91m	0.85m	0.80m
125mm rounds	40	39	40
Engine	5TDF 5-cylinder	V-46-series V-12	gas turbine, 900hp
	horizontally opposed	diesel, 780hp	
	diesel, 750hp		"improved"
Suspension	hydromechanical	torsion bar	
Armour	200mm @ 80°	200mm @ 80°	250mm @ 80°
glacis	100mm @ 60°	100mm @ 55°	100mm @ 55°
lower bow plate	60mm @ 0°	60mm @ 0°	60mm @ 0°
hull side	45mm @ 0°	45mm @ 50°	45mm @ 50°
rear upper plate	20mm @ 70°	20mm @ 55°	20mm @ 55°
rear lower plate	20–30mm	20–30mm	20–30mm
hull top	20mm	20mm	20mm
hull belly	250mm rounded	350mm rounded	450mm rounded
turret front	250mm rounded	250mm rounded	250mm rounded
mantlet	200–120mm	300–120mm	400–120mm
turret sides	60mm	60mm	60mm
turret rear	30mm	45mm	60mm
turret roof	TPD2 coincidence	laser	laser
Rangefinder	2A26 D-81T 125mm	2A46 D-81TM 125mm	2A46 D-81TM 125mm
Main gun			

All subsequent figures apply equally to T-64A, T-72M1 and T-80A:

Max elevation/depression +18°/−5° **Max rate of fire** 6–8rpm **Ammunition carried** 12 HVAPFSDS, 6 HEAT-FS, 22 HE-FS (one less HVAPFSDS in T-72) **Muzzle velocity** HVAPFSDS = 1,680m/sec, HEAT-FS = 905m/sec, HE-FS = 850m/sec **Shell weight** HE-FS = 33kg **Effective range** 2,100m, (HVAPFSDS), 2,300m (HE-FS) **Indirect-fire range** 9,400m (HE-FS) **Turret power control** electric with manual back-up **Gunner's telescopic sight** TShS-49 **Gunner's periscopic day/night sight** TPN-1-49 **Stabilisation** two-plane **Co-axial MG** 7.62mm PKT with 2,000 rounds **AA MG** 12.7mm NSVT with 200 rounds **NBC defence system** PAZ overpressure with PBZ filter system **Snorkel** OPVT **Gradient** 30° **Fording** 1.4m **Radio** R-123M or R-125, more in command versions **Night vision equipment** active infra-red (60m-range, 34°-field TVN-2 for driver; 400m-range, 10°-field TKN-3 for commander; 800m-range, 6°-field TPN-1 for gunner). T-72M, T-80 and retrofitted T-64, T-72A and T-72B have image intensifier and, possibly, passive infra-red with 2.5–3.0km range. Yugoslav T-72 commanders have a passive sight with a five-power magnification, 1km night range and 6km day range.

A T-80, showing the exhaust configuration which suggests that it is turbine-powered, and fabric armour skirts over the suspension. *(US Department of Defence)*

The T-64/72/80 series is the second complete generation of post-1945 Soviet main battle tanks. Though the three types have much in common, they also represent a mix of designs and roles. The series is the result of 30 years of development combined with the latest weapons technology. For all their simplicity, Soviet tanks have always been among the finest in the world. To their traditional virtues of durability and battleworthiness the T-64/72/80 series added a new level of technical sophistication.

While the basic components and arrangement of all tanks in this series are similar, their equipment varies widely in capability. While Western observers have frequently been confused by Soviet tank policies and their expression in the form of actual hardware, the message of the T-64/72/80 series is clear: to their traditional numerical superiority in tanks the Soviets have added a degree of technological sophistication comparable to that found in Western designs. The Western edge in tank optics, fire control and long-range accuracy is no longer as clear-cut as it has been in the past, although in all these areas, as well as armour protection, the best NATO tanks (M1, Challenger, Leopard 2) retained an edge in the mid-1980s. Laser rangefinders, auto-loaders and advanced armour are now standard in the Soviet tank force, and the T-64/72/80 series will remain formidable weapons through the 1980s, comparable to the M60A3s, Chieftains and Leopards that will still make up much of NATO's tank strength.

According to DIA estimates, in 1976–77 the Soviets produced 2,500 tanks a year: 500 each of the T-55 and T-64, and 1,500 T-72s. Annual production of T-64/72-series tanks in 1979 was put at 2,600 units; annual T-72 production has averaged about 2,000. In 1984 total T-64 strength was estimated at 7,900 by DIA. In early 1987 the US Department of Defence estimated that the T-64/72/80 series comprised 75% of the 19,000 Soviet tanks that would be engaged on NATO's Central Front and 33% of the total Soviet tank force. DIA estimates put T-80 and T-80B production at 700 a year in 1983, increasing to 1,000 in 1984, 1,500 in 1985, 2,000 in 1986, 2,500 in 1987, 3,000 in 1988 and 1989, and 2,500 in 1990.

T-72s are reported to be produced at the Nizhni-Tagil Railway Works (Zavod 183), Kharkov Locomotive Works (Zavod 75), Omsk Railway Works (Zavod 13) and Chelyabinsk Heavy Machinery Works ("Tankograd", Zavod 178). They will probably remain in production – for export at least – until the mid-1990s. T-64s were originally produced at Kharkov and first issued to formations near the factory. The Polish T-72 production line is at Labedy, the Czech at Plzen and Martin.

The design origins of the T-64/72/80 series remain unclear. One theory is that the T-64 and the T-72 were developed in parallel by two different bureaux: possibly the Dukhov heavy tank bureau for the T-64 and the Morozov medium tank bureau for the T-72. Alternatively, and more probably, they could have been designed by two teams from the same bureau. The two tanks may have been derived from a single prototype or a single specification. The differences between the T-64 and T-72 could result from a policy of developing one high-technology, high-cost, high-capability tank (the T-64), and a cheaper one embodying less adventurous technology (the T-72).

On the other hand, they may have been designed by one or two bureaux in answer to two distinct specifications. One specification may have called for a design to replace heavy tanks in the long-range fire role, countering the new generation of NATO tanks that was emerging at that time. This would have led to the T-64. The other specification may have covered a T-54/55 replacement, for service throughout the Soviet military and for export, but using advanced systems developed for the higher-cost tank. The result would have been the T-72.

A third possibility is that the T-64 was originally seen as a replacement for the T-54/55 throughout the Soviet Army, but fell foul of technical problems and rising costs. It was then decided to emphasise the T-72, created by marrying some elements of the T-64 to proven technology. It may also have been that the T-72 was available as a back-up or export design when the T-64's problems led the Soviets to shift emphasis.

T-64

The first T-64 prototypes showed that this was an innovative design, with a coincidence rangefinder for long-range accuracy; autoloader; and a new horizontally opposed 5-cylinder, high-compression-ratio multi-fuel engine, with a high power-to-volume ratio, mounted on its

side to fit in the low hull. The running gear included track-support rollers and metal roadwheels without rubber rims. The track was of the double-pin type, retained throughout the T-64 series. "Combined armour" was used, at least on the glacis, and spring-loaded gill armour supplemented the side protection. The first T-64s may have been armed with a shorter-barrel 125mm gun or may have introduced the new 2A26 125mm smoothbore; they did not apparently have the T-62's 2A20 115mm smoothbore. The first prototypes were completed in the early to mid-1960s, possibly as early as 1961–62. These prototypes may have been the tanks identified as "T-67" and "T-70" in the West.

T-64A

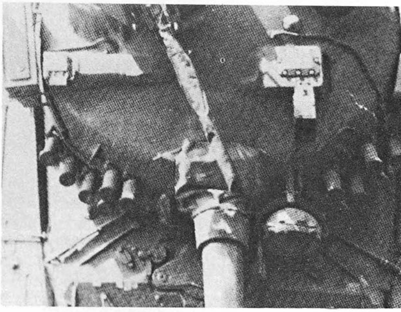
The T-64 prototypes were soon followed by the T-64A with the 2A26 125mm smoothbore and, probably, an advanced hybrid hydro-pneumatic suspension. It is reported to have passed state trials in the mid-1960s and to have started to enter service with line units by 1967, beginning with the 100th Guards Tank Training Regiment and 41st Guards Tank Division. The latter unit is believed to have left one of its regiments out of the Czechoslovakian invasion of 1968 because it was working up on the new tanks. The T-64A was known as the "M-1970" or "T-70" in the West when first seen. It is also known simply as the "T-64".

The right-hand fender, used for tool storage on prototypes and early-production T-64s, was turned into an external fuel tank. The 12.7mm NSVT can be fired from under armour. The commander's cupola is able to rotate independently of the turret, allowing him to keep his sights on a target different from that being engaged by the gun. This feature was retained in Soviet T-72s at least.

Both the basic T-64 and the T-64A had bad mechanical problems. The autoloader developed a particularly spectacular malfunction which, combined with poor human engineering, kept these 125mm-armed vehicles crippled until at least the late 1970s. The engine and transmission were too sophisticated for the crews and had a high breakdown rate. An expensive tank to begin with, the T-64 must have been still more costly following

Below: Turret top of a T-64A, showing standard arrangement of 12 smoke mortars at the front, laser rangefinder, and ammunition and stowage boxes next to the hull. The boxes and smoke mortars are mounted differently on T-64s fitted for reactive armour. *(US Army)*

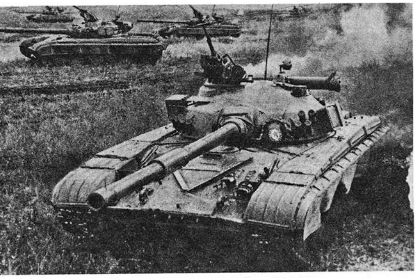
Bottom: T-64A main battle tank with fabric armour skirts replacing the earlier gill armour plates. It has smoke mortars mounted on the turret face. *(US Department of Defence)*



modification. It took most of the 1970s to fix the T-64's problems. Production is reported by US Army sources to have continued until 1981, although "Viktor Suvorov", a former Soviet officer, believes that production stopped in the early 1970s.

T-64 M-1980/2 (NATO designation)

A retrofitted version with an enlarged gunner's sight, possibly indicating a laser rangefinder. Armoured side skirts are fitted in place of the armoured gills. Some examples have also been retrofitted with smoke mortars on the right-hand side of the turret, while others have a full battery of 12, mounted on both turret sides. A bump stop is provided for the fourth road wheel.



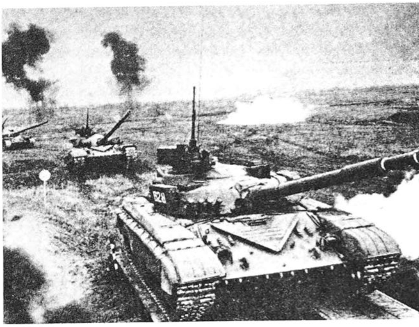
T-64B with Songster guidance equipment. Unlike the T-64Bs illustrated on page 138, it has no larger optical sight mounted on the turret top.

T-64 M-1981/1

Similar to the M1980/2 but with smoke mortars mounted on the rear sides of the turret. These vehicles all have attachment hinges for skirts, though these are not always fitted.

T-64B

Armed with the AT-8 Songster ATGM (Soviet nickname *Kobra*), possibly as a result of the long-range accuracy limitations of Soviet 125mm smoothbores, the T-64B is in service with a number of Soviet units. It differs from the T-64 M-1981/1 tanks only in having its laser optical tracking and designation system located in an armoured mount in front of the commander's cupola. The L-shaped mount for Songster guidance equipment is the only apparent provision for that system when it is not mounted. The smoke mortars are mounted in two groups of four each on the rear flanks of the turret. The May 1985 Red Square parade featured T-64Bs without visible AT-8 guidance equipment. While T-64A production had halted by the early 1980s, T-64B production continued. T-64Bs were reported to be replacing T-62s in GSFG in the mid-1980s. Alternatively, T-64As may have been brought up to T-64B standard.



A column of T-64s of Group of Soviet Forces Germany crosses an engineer bridge. They have fabric armour skirts and smoke mortars on the turret face. These examples are not configured to accept reactive armour but probably will be in the near future. *(US Army)*

T-64K and T-72K

These command versions have navigation and radio systems similar to those of the T-62K. They cannot move with the 10m mast antenna erected. They retain the main gun (probably with reduced ammunition) but the 12.7mm machine gun is removed.

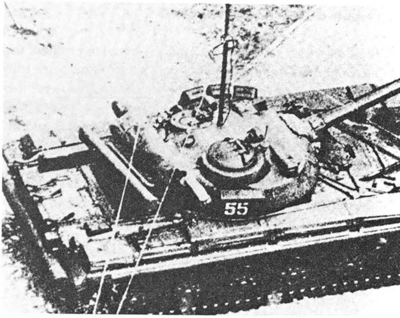
T-72

T-72 prototypes and pre-series trial production examples were evaluated in the late 1960s, development having probably begun in the mid-1960s or earlier. The initial production version, the T-72A, entered production in 1971. Over a dozen major sub-types have since been identified.

The T-72 series embodies existing rather than innovative technology: the V-46 engine (a turbocharged version of the standard Soviet tank diesel), torsion-bar suspension and stadia rangefinder are all less sophisticated than their T-64 equivalents. But similarities in basic design and layout remain, and the 2A26 125mm gun and its *korzina* (basket) autoloader are common to the T-64A and T-72A.

The original early-production T-72A was soon sup-

Right: A T-64K command tank with its 10m radio mast extended. The tank cannot move until the mast is stowed. The main gun is operational, although ammunition load is believed to be reduced. *(US Department of Defence)*



Below: A company of standard production T-72s moves in line across snow-covered ground. The T-72 has better cross-country performance than the T-62 and so is used by reconnaissance battalions and in peripheral areas of the Soviet Union, where such mobility is especially valuable. *(US Army)*

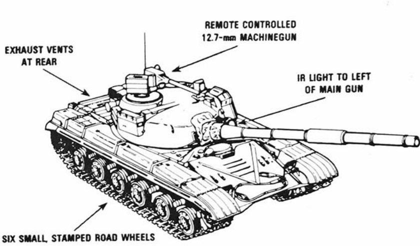
planted in production by the standard T-72B (also possibly known as the T-72B46), the visible difference being the shifting of the infra-red searchlight from the left (as on the T-64) of the gun on the T-72A to the right on the T-72B. The most important change was the introduction of the 2A46 125mm smoothbore with a modified *kasetka* (cassette) autoloader which stored 23 rounds in a two-tier tray on the floor of the turret basket. The T-72B was first paraded in Moscow in November 1977. Since its appearance, a number of retrofits have been applied to at least some of the T-72Bs in Soviet service. The designation T-72B(M) has been given to such modernised tanks, although its use by the Soviets cannot be confirmed. Laser rangefinders, two panels of armour plate welded to the turret front, and smoke mortars have appeared. While most examples appear to have retained the gill-type armour, some may have the armoured skirts of later versions.

T-64A and T-72B compared

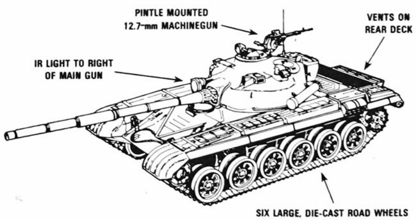
The searchlight was moved from the left to the right of the main gun, and the T-64A's cupola 12.7mm machine gun mount was replaced by a pintle mount in the T-72; this NSVT mount is simpler, smaller and with better elevation, and has been retained throughout the T-72 series and on the T-80. The V-46 engine of the T-72 is improved over the T-64A's V-55 in having a supercharger, a cyclic fuel supply to the cylinders, and multi-fuel capability, permitting petrol or kerosene to be used instead of the usual diesel if circumstances dictate. Recognition features of the T-72B are listed below, with data in parentheses showing how the T-64A differs:

- Rubber-coated (uncoated) road wheels
- Three (four) support rollers
- 14 (12) tooth drive sprocket
- Single (double) pin track, rubber-bushed track pins
- Turret round at front, egg-shaped at back (entirely round)
- Infra-red searchlight on right (left) of gun
- A few small (more, larger) storage boxes on the turret
- 12.7mm MG on pintle (cupola) mount
- Single short snorkel on left side of turret (longer snorkel, with a second for the engine inside it, on the rear edge of the turret)
- Large (small) engine compartment, radiator grill near rear (turret), integral fuel cells on entire right track cover and rear half (all) of left track cover.

T-64



T-72



Differences between the T-64 and T-72. *(US Army)*

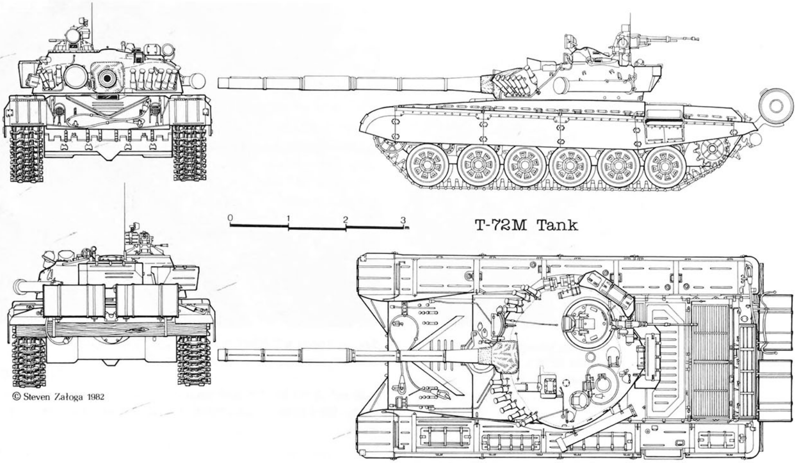
T-72G

The T-72G is an interim type with the laser rangefinder and other fire-control improvements associated with later T-72 models; incorporation of these systems led to the sight of the optical rangefinder being deleted from the turret roof. While the T-72G's turret armour is probably thicker than that of the T-72B, as evidenced by its different turret frontal shape, it lacks the thickened frontal armour of the T-72M. The shift from hinged 6mm gill stand-off armour plates over the suspension to fabric armour skirts in new-production T-72s started during T-72G production. T-72Gs have been retrofitted with 12 smoke mortars. The T-72G was the first version to be produced in Poland and Czechoslovakia, the first coming off the line in 1978. The T-72 version produced in Yugoslavia, the M-84, appears to be equivalent to the T-72G.

T-72Gs on exercise.

T-72M

First seen in 1980, and so known to NATO as the T-72 M-1980/1, this version also replaces the T-72's optical



rangefinder with a laser, leading to deletion of the optics port and rangefinder housing on the right forward turret roof. The T-72M has improved skirt armour, covering the track-support rollers and extending down to the tops of the roadwheels, in place of the earlier gill armour. Added during the T-72M production run, the skirts are often not fitted in peacetime to avoid damaging them. The T-72M has improved turret armour, possibly including combined armour on the turret front, and significant internal improvements. The resulting thickened front has led US tankmen to nickname the T-72M the "Dolly Parton tank". An additional layer of external armour, about 25mm thick, was added to the turret roof; this may act as radiation shielding. The T-72M was not originally fitted with smoke mortars, but these can be retrofitted.

The command version, the T-72MK, supplanted the original T-72K in production.

Though the T-72M was first seen in 1980, it may have entered production in the Soviet Union in about 1978, and production probably overlapped with that of the T-72G.

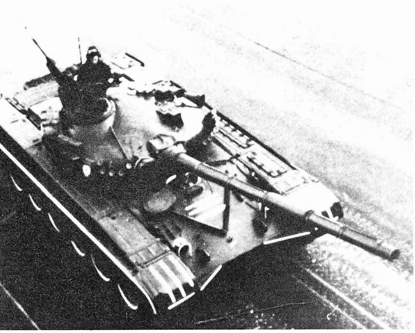
An early T-72M without smoke mortars.

T-72M1

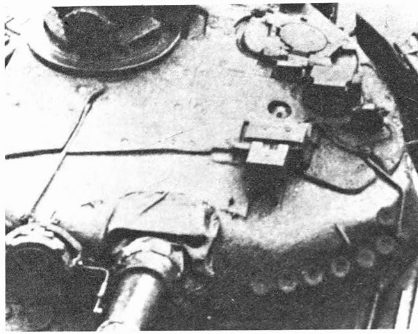
While the first production T-72M1s did not have smoke mortars, examples with smoke mortars on each turret face were first seen in 1982. The T-72M1 has a number of internal improvements, probably comprising upgraded fire control, full fire-on-the-move gun stabilisation, and an improved fire-suppression system in place of the T-62-style arrangement used on earlier versions. The T-72M1 has better armour than the T-72M, including an added panel of armour plate on the glacis. When first seen by Western observers it was thought to be theT-80, but was later called the T-72M1 or T-72 M-1981/3.

T-72M1 M-1984

In 1984 a new version, called the T-72M1 M-1984 by NATO but possibly designated T-74 by the Soviets, was



Above: T-72M1, characterised by smoke mortars, altered turret shape to allow for increased protection, and laser rangefinder. *(US Department of Defence)*



Above: Top of a T-72M1 "Dolly Parton" turret, showing additional armour on front and top. *(US Army)*

seen. It has additional anti-radiation lining to the turret, extra appliqué armour on the turret roof, and a third stowage bin (suggesting reduced turret space) fitted to the left rear of the turret, where the snorkel is normally kept; the snorkel is moved to the underside of the rear storage bin.

"T-74B"

"T-74B" is a possible designation associated with a version of the T-72M1 armed with the same AT-8 Songster ATGM as the T-64B. Like the T-64B, it retains full 125mm capability, although ammunition stowage may be reduced. "T-74B" deployment has not been confirmed.

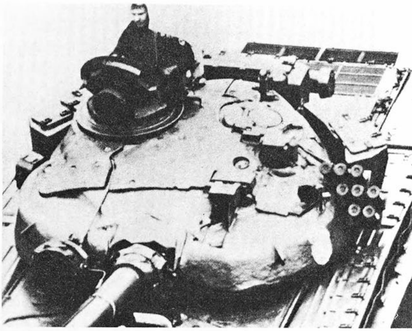
T-72M1 M-1986

In November 1986 the Soviets paraded this uparmoured version of the T-72M1. Even thicker armour, earning this

Below:T-72M1 M-1984 tank on parade, with 12 smoke mortars on the front of its "Dolly Parton" turret, and fabric armour skirts.

variant the nickname "Super Dolly Parton", has given the turret front a more angular profile, suggesting that combined armour may be fitted. The additional turret roof armour of the T-72M1 has been extended to the upper hull surface near the driver's hatch. The glacis armour may also have been increased. The T-72M1 M-1986 has only eight smoke mortars instead of the usual 12, mounted only on the left rear side, possibly to leave room to fit shoebox-style reactive armour. The ready ammunition for the externally fitted 12.7mm NSVT is halved to one box. The main gun sight and the infra-red sight head are both larger, and the infra-red sight has a different cover plate, suggesting improvements.

At least some T-72M1 M-1986s have been fitted with reactive armour. Changes associated with this armour include removal of the last 12.7mm ready ammunition box and the fitting of armour plates on the turret roof on both sides of the gun shield.



Above: T-72M1 M-1986 "Super Dolly Parton", showing thickened turret front, additional armour and shielding on turret top, and modified placement of smoke mortars and stowage to permit use of reactive armour. *(US Army)*

BREM-1

The BREM-1 (*bronirovannaya remontno/evakuatsionnaya mashina*, armoured repair and recovery vehicle) combines the T-72 chassis with a 12 tonne-capacity (19 tonnes with lifting blocks) hydraulic crane, electrical welding system, 100 tonne-capacity forward pulling winch (with special tackle, 25 tonnes otherwise), hydraulically operated dozer blade instead of the T-72's entrenching spade, and a 12.7mm machine gun. It equips T-72 tank regiments.

IRM-2

The IRM-2 is a combat engineer vehicle based on the T-72 chassis. Details in **Engineer equipment** chapter.

T-80

The T-80 may be a successor to the T-64, and includes many of the upgrades introduced during the latter's production: improved armour, smoke mortars and a laser rangefinder. Its turret resembles that of the T-72M, however, while the engine is reported to be a turbine venting towards the rear. Placement and shape of the exhaust are consistent with a 900–980hp turbine. Meanwhile, research into diesel engines continues, and there is no reason to assume that the T-72's V-46 V-12 design is as far as Soviet tank diesels can go.

A new suspension is intended to cure the T-64's noise and vibration problems at high speeds. Conventional rubber-rimmed roadwheels, smaller that those of the T-72, replace the resilient-steel wheels of the T-64. The roadwheels are reported to comprise two halves bolted together, with the central guide teeth of the track passing between the halves. The track is believed to be of a new design, and may have been increased to 0.63m in width. The middle two pairs of wheels, under the turret, are spaced closer together than the others, possibly to support the uparmoured turret. The T-80 may have an automatic powershift gearbox with a preselection.

There are probably two T-80 versions, both with the 125mm gun but one also being able to use the AT-8 Songster. Alternatively, all T-80s may be able to use Songster.

Other differences from the T-64A include the location of the main IR searchlight to the right of the main gun, and different turret stowage. The T-80 has a new two-snorkel system, both snorkels being mounted at the rear (T-64s have a single unit on the turret). Externally, the armour seems to be similar to that of the T-72M. All in all, T-80 is very much an example of evolutionary development.

According to US sources, production of service test machines started in 1979. Full-scale production did not get under way until 1983, and a total of 1,400 examples are said to have been in service by 1984. The CIA estimates that a T-80 costs three times as much as a T-55 and reports that a new production facility and a network of component suppliers had to be set up. The T-80, more sophisticated than any previous Soviet tank, will require substantial service support in the field.

T-80 Follow-on

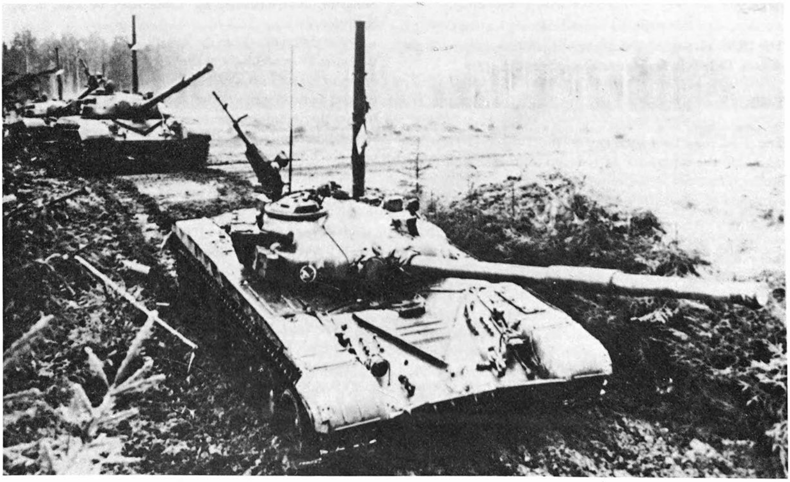
According to US Congressional testimony, a new, even more advanced battle tank, designated Future Soviet Tank 1 (FST-1) by the US Army, is currently under

development, along with other projects. The US Army predicts that the Soviets will introduce two new main battle tanks in the early 1990s.

Improved protection is thought to be one of the main features of FST-1, being equivalent on the glacis to 700mm of rolled homogeneous armour, while top armour is equivalent to 80mm.

Above: A T-80 with characteristic "shoeboxes" of reactive armour. Their position suggests that they are intended to defend against top-attack shaped-charge weapons and sub-munitions. *(US Department of Defence)*

Below: T-72M1s with combat snorkels erected.



In 1983 the DIA estimated that FST-1 would enter production in 1987, with 200 a year being built initially, rising to 500 in 1990. However, there have since been reports that this tank, with stratified Chobham-type armour, appeared in Soviet service in Czechoslovakia in 1986, suggesting that production had started by about 1983.

The US Army expects FST-1 or the FST-2, its follow-on (itself possibly one of the 1990s tanks), to be a 42-tonne design with a larger-calibre – possibly 135mm – gun and an improved engine. Other projected features include lasers and microwave radars capable of disrupting enemy sensors. A turretless design, also using the 135mm gun, has been reported.

Hull and turret

The T-64/72/80 multi-piece cast turret and all-welded steel hull with rectangular cross-section are similar to those of earlier tanks. The hull is divided into two compartments, there being no bulkhead between the driver and the turret. The driver has been moved to the centre of the glacis from the left-hand side, and his hatch is protected from rushing water by fording plates.

Though the turret is about the same size as that of the T-62, it contains only two men – the commander and the gunner, the loader being replaced by the autoloader – the remaining space being taken up by the larger gun, additional fire-control equipment and thicker armour. The commander sits on the right and the gunner on the left, allowing the gunner to load rounds with his right hand if manual operation is required.

An integral retractable dozer blade is fitted to the hull front, and T-64/72/80s can dig themselves in in 12–30min. The blade is however apparently intended more for improving movement over marginal paths than for intense construction. The Iraqis are reported to have burned out the transmissions of some T-72s by using them as bulldozers in 1980–81. The dozer blade can also be used to push belly mines out of the way.

The T-72 snorkelling system appears to be similar to the standard OPVT used on the T-62, although the T-64 series has a second exhaust snorkel for the engine.

Suspension, tracks and engine

Compared with the T-54/55/62 series, new suspension, tracks and engine have not only increased both road and cross-country speed, but have apparently also reduced the vibration and track-shedding that plagued the earlier tanks.

The T-64's hydromechanical suspension was possibly intended to give a more stable ride for firing on the move. It presented many problems, including a proneness to loss of pressure, and was not adopted for the T-80 design.

The T-80's road wheels have rubber rims, which those of the T-64 lack, and the tracks are of an improved design, using connectors rather than pins and fitted with rubber pads.

Throughout the T-64/72/80 series the controls are power-assisted. Reports have suggested that the T-80 (possibly late-model T-72s as well) has automatic transmission, although T-64s and all exported T-72s retain the standard Soviet manual transmission.

T-72 track is live, articulated in a double axis with single track pins (compared with double pins on the T-64) and rubber bushings. The T-72 style of live track was originally developed for the modernisation of T-55s and T-62s, although tracks for these tanks will not fit the T-72. There are reports that all T-55s and T-62s will eventually be modified, by replacing their drive sprockets, to accept a similar track, the RMSh.

Protection

The T-64/72/80 series has better protection than the T-62. Glacis slope has increased and the armour on the T-72 is reported to be up to 20% thicker in places than that of the T-62. Armour weight is 500–1,000kg greater than for the T-62. The T-64's armour over the frontal 60° arc has been estimated by US engineers to be equivalent to 550mm of rolled homogeneous armour. This suggests the use of combined armour, with alternating layers of steel and other substances, including glass, ceramics or honeycomb. The turret is reported to be cast with a frontal cavity that could accommodate a variety of fills, most probably alternating layers of ceramic or other material with steel. The front upper glacis may be of rolled-steel plate rather than a casting. Other armour on the T-64 includes a thicker turret roof.

Some of the weight increase between the T-64 and the T-72 is believed to be due to the latter's improved protection, although in the frontal arc the two are comparable, with protection equivalent to 550mm of rolled homogeneous armour.

While 200mm of Chobham-type armour is reported to provide protection equivalent to 900mm of conventional armour, Soviet-style combined armour is believed not to be as effective. Nevertheless, it still represents a significant increase in protection. Unconfirmed reports state that the glacis plate on the T-64B and T-80 comprises 200–230mm of combined armour at a 60–68° slope. The laminate is believed to comprise three layers of steel – each possibly produced by a different process – and one of fibreglass, with the anti-radiation and spalling liner as a backstop. The lower glacis plate is reported to be 80mm thick at a 60° angle. Its laminate lacks the fibreglass layer, but this is offset to some degree by the protection from the

20mm-thick dozer blade, which retracts against the lower glacis. Thickness of the glacis probably increases gradually from the 200mm of early production T-72s to the 230mm of the T-72M1. T-72s can mount additional external steel turret armour similar to that of T-55/62s.

While the T-80's protection appears to be about the same as that of the T-64 and T-72, it is reported to be more effective. Some of the T-80 weight increase probably went into protection, possibly including greater use of laminate in the hull glacis. The T-64 and T-72 originally had four 6mm-thick armoured skirting plates attached each side to protect the suspension against small HEAT warheads and fragments. Hinged to brush past obstacles, they have since been supplanted by fabric "skirt" armour.

The late Dmitri Ustinov, then Soviet Minister of Defence, boasted to the Austrian Defence Minister: "Our tanks are invulnerable to ATGMs." While it is likely that this claim was intended for effect, it does underline the fact that advances in T-64/72 armour have undercut the capability of NATO shaped-charge warheads. Dr Perry Pierre, then Assistant Secretary of the US Army, stated in 1979 that the T-64/72 had "at least first-generation advanced armour," including spaced armour and new metallurgical techniques.

The combined armour of the T-64/72 is obviously different from Chobham armour, since these tanks lack the slab sides associated with the British system. The Soviets have been working on combined armour since 1961, and the fruits of their efforts are evident in the haste with which the armies of the West have looked to improve the HEAT warheads on weapons such as TOW, TOW 2 and Milan.

It is however likely that some export T-72s lack combined armour. (Though Yugoslavian T-72Gs are said to have "sandwich armour that cannot be pierced by most modern anti-armour projectiles", and late-production Czech T-72Ms to make extensive use of combined armour in the glacis plate.) Soviet versions prior to the T-72M or T-72M1 may have lacked it as well. Export versions also lack the radiation shielding fitted to those produced for Warsaw Pact armies. It is believed that late-production Czech T-72Gs make extensive use of combined armour in the glacis plate.

The Soviets have fitted reactive armour to a number of main battle tanks. The T-80 and T-64 were among the first to appear with the new armour, starting in about 1984; this is consistent with the use of these tanks by high-readiness formations. About 6,000 tanks are believed to have been so fitted by mid-1987. All the tanks in the Groups of Forces on the Central Front will probably have reactive armour by 1989–90, and the T-72 and earlier tanks are likely to receive it soon after. In 1987 Syrian T-72s were reported to have reactive armour. This effort, along with the use of combined armour, may represent an attempt to reduce the protection gap that exists between the T-64/72/80 and the best NATO tanks.

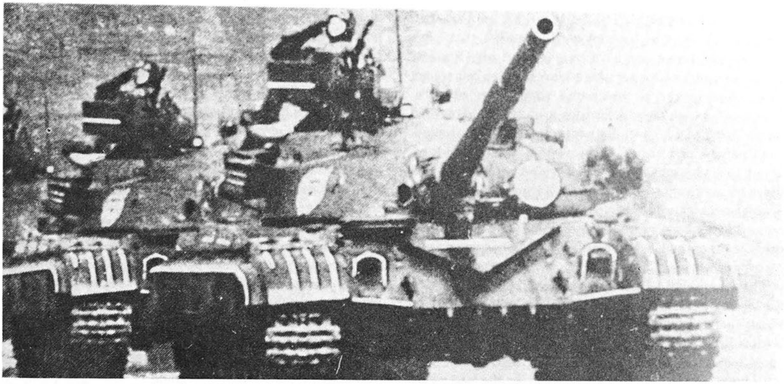
Soviet reactive armour is reported to be similar to the Blazer system used by Israeli tanks in the 1982 Lebanon War. This is possible, as a Blazer-equipped M60A3 was captured by the Syrians. But the Soviets have been aware of the potential of reactive armour since its development in the West in the 1950s, and are also reported to have had access to the same Western patents and research that led to the Israeli system. A set of reactive armour would add 2.5–3 tonnes to the weight of a T-64, so it is likely that it would not normally be fitted in peacetime. In this respect the Soviet system differs from the Israeli, requiring no grid of permanent attachment points. T-64Bs have however been seen with external modifications relating to reactive armour; these include the mounting of the mortars and storage bins 20cm away from the turret wall, and removal of some of the traverse ribs by the fording plates around the driver's hatch to allow the reactive armour to lie flat.

Reactive armour contains small charges of quick-acting explosives. If it is struck, the resulting explosion disrupts the penetrative jet formed by a shaped-charge warhead, much as dynamiting can snuff out an oil well fire. In the past there have been problems with the detonation of reactive armour by machine gun rounds or shell fragments, imperilling troops nearby and revealing the tank's position. Armour segments could also be knocked off by branches when moving through forests. The Israelis claim to have solved these problems, although Blazer can only be used by main battle tanks, the blast being too powerful for APCs.

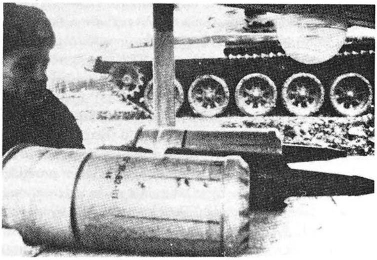
Soviet reactive armour is, like the Israeli system, based on externally mounted "shoeboxes", each measuring about 250mm × 120mm × 70mm and containing an explosive charge. Four bolt holes on each box allow them to be connected, and mounting pins permit attachment to the tank at a stand-off distance of at least 50–75mm. Soviet reactive armour is mounted not only on the front and sides of the tank but also on its top. No boxes appear to be fitted to the side skirts of the T-80, while the T-64s can have two to four rows. There is no coverage of the hull or turret rear of the engine deck. A T-80 requires about 110 boxes, a T-64B about 185–210.

The arrangement of Soviet reactive armour suggests that it is directed in large part against current or projected Western top-attack systems, many of which are the sharp end of emerging-technology deep-strike systems. These systems have relatively small shaped-charge warheads and could well be defeated by reactive armour, as could smaller shaped charges like those used by light anti-tank weapons. The Israelis deployed reactive armour to make their M60s and Centurions less vulnerable to RPG-7s, and it apparently succeeded in this during the 1982 Lebanon campaign.

Without doubt the improvements in main battle tank protection seen since the 1970s have greatly reduced the tank-killing efficiency of the HEAT warhead. But stopping



Above: These T-64Bs on parade have fittings for reactive armour. *(US Army)*



Right: 125mm HEAT rounds showing the spike nose – different from the ogival nose usually found on such rounds – and the separate shell and charge, the latter with its non-combustible stub case. The stub is sometimes ejected manually through the hatch rather than automatically. As on the T-62, this creates a risk of crew injury. *(US Army)*

a high-technology HEAT warhead about 150mm in size could still be difficult for T-64/72/80s, even with reactive armour. The US Army claims that the tandem warhead of TOW 2 will defeat reactive armour. This armour will however apparently defeat any of the light anti-tank weapons currently in use by NATO armies.

The NBC defence systems of the T-64/72/80 series are superior to those of the T-62. Like the BMP, they have a PBZ air filtration (FVU in Soviet nomenclature) system in addition to the standard PAZ overpressure system. NBC protection is also reported to have been increased to the point at which the tanks can be considered "mobile reactor shields". They are said to be lined with 20–30mm of lead-based foam – an earlier design comprised lead pellets in a plastic blanket – to limit the effects of neutron radiation and electromagnetic pulse. This liner, believed to be 40–70mm thick, also reduces spalling and noise. The thickened turret-top armour seen on the T-72M1 M1984 and T-72M1 M1986 may also act as radiation shielding.

The T-72 retains the T-62's ability to create smoke by injecting diesel fuel into the engine exhausts. The T-64 and T-80 may have a similar capability. There are unconfirmed reports of a laser warning system on the T-80 at least.

Armament

The most common armament for the T-64/72/80 family is the 2A46 D-81T 125mm tank gun, a development of the earlier 2A26 125mm weapon that appeared on some versions. Both may have been developed from an earlier, short-barrel 125mm weapon and the 2A20 U-5TS 115mm tank gun, retaining the latter's characteristics of high velocity and flat trajectory, as well as its problem of dispersion at long range. Despite the round's high muzzle velocity, it is still susceptible to crosswinds and weather-vaning. This may have contributed to the decision to rely on the Songster ATGM for long-range accurate fire.

The 2A46 has external thermal shielding, and a bore evacuator is positioned a third of the way down the barrel. As with the U-5TS, its barrel life is less than that of a comparable Western tank gun; the Iraqi Army is reported to have found that 125mm barrels burn out within about 120 rounds in action.

The D-81T fires HVAPFSDS, HEAT-FS and Frag-HE rounds. There are unconfirmed reports that the HVAPFSDS round has a "secondary cartridge" which acts as an in-barrel booster; this is more likely to be a tracer shoe. Photographs of this round show what may be provision for a Makarov ballistic cap, which would make it an HVAPCFSDS round. The penetrator appears to have a length-diameter ratio of about 12:1 and a diameter of about 40% of the calibre. The cartridge appears to be of the semi-combustible type, leaving a large brass stub. This arrangement possibly avoids the problems of carbon monoxide exhaust, case disintegration and secondary explosion that the US Army encountered when using such cartridges.

The 125mm HEAT-FS round has a spike nose instead of the ogival nose of previous HEAT rounds. Improved fuzing increases effectiveness against sloped armour. The Soviets have noted the Western development of stabiloy (depleted uranium) shells, and there are reports that they have been working on such a projectile. In the late 1970s the Soviets were apparently neither exporting nor themselves using stabiloy or tungsten carbide penetrators for 125mm weapons, although they were capable of producing them. Current standard 125mm penetrators, like those of 115mm rounds, are of steel, though advanced penetrators may now have entered service.

The T-72's "cassette" autoloader, containing 23 rounds, is mounted on the turret floor and rear wall. The remaining ammunition is stowed in racks behind the turret basket (three rounds) and, continuing the Soviet practice of using diesel fuel to protect ammunition, in indentations in the fuel cells (13 rounds). The carousel is of a two-layer design, with the charges above and the projectiles below, each in its own "cassette". A Songster and its propellant charge could possibly fit into this system.

The earlier "basket" autoloader design was used on the early T-72 and T-72A and the T-64 and T-64A; the T-64 version may have differed. Both basket and cassette have the ammunition stowed with the projectile noses pointing towards the centre and the charges standing vertically behind them.

In the cassette system the shell and then the charge are placed in front of the rammer and seated into the breech with one motion of the rammer. In the basket system the carrier must first grip a round and position it behind the power rammer, which seats it in the breech. The process is repeated for the charge, the rammer then moving again to load both projectile and charge before the automatic breech closes.

With both types of autoloader the gun automatically elevates to load, as on the BMP, and the expended stub casing is automatically ejected through a port in the turret back, as in the T-62. Malfunctions are still common.

According to several reports, however, 125mm autoloaders, especially that used on the original T-64, do not always work as they should. The ejection port is frequently misaligned, requiring the installation of a shield against rebounding brass inside the turret. The system even has a tendency to grab the gunner and attempt to load *him* into the breech. In the words of one US Army officer: "We believe this is how the Red Army chorus gets its soprano section." (As the gun elevates to load, ill-fitting tank suit trousers could easily get caught in the mechanism, with predictable results.) If this is the case, then modification of the protective gun cage could have been needed, although the shortage of turret space would make this difficult. Whatever the truth of these reports, it is known that T-64 units in Group of Soviet Forces Germany were not, as of 1979, using the autoloader. It is not known whether the T-72B and later models have ever suffered from these problems, or whether they are confined to the T-64-style autóloader.

It is possible that movement over rough ground or the shock of a non-penetrating hit on the tank can misalign the autoloader. If that happens, going to manual loading is difficult, as the gunner has to load both shell and cartridge by hand, reducing the rate of fire to no more than 2rpm. Poor human engineering may have seriously undercut the combat power of these tanks.

The fire-control system on a number of T-64/72/80 variants is now based on a laser rangefinder, with a telescopic rangefinder to check on laser measurements as required. A stadiametric rangefinder, similar to that on earlier tanks, may serve as a back-up. An analogue ballistic computer linked to the gun converts the rangefinder inputs, plus other entered data, into range and elevation. This is the most complex system ever to appear on Soviet tanks, and it is not known whether it has been a success. The T-64/72/80 series has a further advantage over the T-62 in that the commander can elevate and fire all weapons from his position.

The T-64's stabilisation system was an improvement over that of the T-62. Along with the superior shock-absorption capabilities of its suspension, this gives the T-64 an improved fire-on-the move capability.

Land navigation systems

T-64/72/80 command versions are believed to have an improved version of the TNA-3 land navigation system, permitting operation within a 100m grid square without resetting. Present location is displayed in the form of plus or minus co-ordinates on 1,000m and 200m scales, with bearing to destination indicated on a separate dial.

Optics

The night vision devices used on the T-64/72/80 series are an evolutionary development of those of the T-62. The T-80 may have a thermal pointer, if not a full

thermal-imagery sight. T-64s and T-72s produced in the late 1970s have active infra-red equipment, including the same type of IR searchlight as the T-62, and there have been reports of image-intensifier systems, as used on the T-80, being retrofitted to T-62s and T-72s. Passive night-vision devices – including the TPN-1-49-23, (the gunner's primary infra-red sight), TKN-3 and FG-125 systems, improvements on those of the T-62 – are mounted, as are two white-light or infra-red searchlights, the main unit next to the gun tube and one for the commander on his cupola.

The T-64A M1980/2 and T-72G and later versions of their respective designs include a laser rangefinder with telescopic optical back-up. The optical gunsights on earlier versions were stabilised, although the commander's sights were not. The main optical sight-head does not traverse to track moving targets on the earlier tanks, although this facility may have been added later. The T-64 and T-64A have a TPD-2 coincidence rangefinder, the T-72 a simpler stadia system.

The Soviets have long been concerned with the helicopter threat to tank forces and have sought to give them a self-defence capability. There are reports that at least some T-64Bs have "radar-based target-acquisition electronics" that would allow them to engage helicopters at a range of up to 10km, presumably with AT-8 or another on-vehicle missile. This may be a millimetre-wave (100GHz frequency) radar, similar to a number of proposed US systems.

Weapons effectiveness and combat usage

First-round hit probability of the Soviet 125mm gun, fired against a 2.3m-square target from a stationary tank is as follows:

	Range (metres)				
Ammunition	**1,000**	**1,500**	**2,000**	**2,500**	**3,000**
HVAPFSDS	87%	66%	46%	31%	22%
HEAT-FS	73%	36%	16%	6%	2%

HVAPFSDS fired against steel armour would achieve the following penetration:

Range (m)	500	1,000	1,500	2,000	2,500	3,000
Penetration (mm)	420	350	335	325	280	245

Use of tungsten alloy penetrators would add about 100mm to these figures, use of stabiloy about 150mm. Penetration by the HEAT round would be 475mm, regardless of range.

T-72s first saw action in limited numbers in Afghanistan, where they are probably organic to divisional reconnaissance units. T-72s were used in the Panjshir Valley in 1982 and have also been reported operating in the Ghazni area and along the Salang highway north of Kabul. The most extensive combat use of the T-72 was in Lebanon in 1982. There Syrian T-72Bs and T-72Gs proved vulnerable to Israeli 105mm M-111 APFSDS tungsten steel penetrators (eight reported kills) and TOW ATGMs (albeit with Israeli-improved warheads). It is possible that the early versions of the T-72 supplied to Syria did not have combined armour, unlike newer tanks.

In the Iran-Iraq war Soviet-built T-72Bs and Czech and Polish-built T-72Gs have comprised a large part of the Iraqi tank force, proving effective against Chieftains in the January 1981 fighting around Susangherd. Through most of the war the main threat has been hand-held anti-tank weapons, although T-72s proved vulnerable to TOW ATGMs in both 1980 and 1987.

Tactical employment

In the early 1970s T-64s began to be shifted to Group of Soviet Forces Germany from the western military districts, where they were supplanted by T-72s. In 1979 each Soviet tank division in East Germany had one T-64-equipped regiment, as did a number of the Category I tank divisions in the European USSR. A second and third regiment was then added to each division, replacing T-62s. T-64s are still found in high-readiness divisions in the western military districts, as are T-72s. By the end of 1984 T-64Bs were in service in GSFG.

Early-production T-72s have appeared in photographs taken in the Far East and Trans-Baikal military districts, and enough should be produced to equip even low-readiness divisions. The Naval Infantry started to receive T-72s, replacing T-55s, in the mid-1980s. The first T-80 entered service in GSFG in January 1984, equipping regiments in the 1st Guards Tank and 8th Guards Armies. It is believed that in 1986–87 the tank units of the 2nd and 20th Guards and 3rd Shock Armies (all GSFG) were still using T-64s, those of 1st Guards Tank and 8th Guards Armies using T-80s. Units in the Carpathian, Byelorussian and, possibly, Kiev military districts also are equipped with T-80s. Czech-based units have T-72s.

Engagement sequence

The improved systems on T-64/72/80-series tanks have led to some differences in engagement sequence compared with the T-62. In T-72s with stadia rangefinders, the commander determines the range to the target, as on the T-62. On tanks with laser or coincidence rangefinders, however, the gunner uses these systems. The range is fed directly into the fire-control computer as well as being displayed to the gunner and commander. When the gunner is ordered to load, he uses his control panel to index the correct type of round in the autoloader, which then goes through its sequence. The gunner also makes sure that

the fire-control computer is set for the correct type of ammunition. It is not known whether environmental factors such as crosswinds or barrel heat are automatically entered into the fire-control computer; if they are not, as seems likely, the gunner must input this information. As the gun is stabilised in elevation, it returns to the required elevation after loading. The gunner lays the gun electronically with a two-handed controller or, alternatively, manually with elevation and traverse handwheels. Because the sights are apparently not stabilised in azimuth, internal offsets must be used to track crossing targets.

The rest of the engagement sequence remains similar to that of the T-62.

Vulnerabilities and countermeasures

While the improved armour and protection of the T-64/72/80 series make them less vulnerable than the T-54/55/62 series, many characteristics remain common to both. The absence of a loader reduces crew exposure to penetration. However, the autoloader, especially if it is of the basket type, may increase vulnerability to ammunition explosions resulting from penetration. The basket may also be vulnerable to shaped charge anti-tank mines. The reserve ammunition is stowed amidst fuel, as on earlier tanks, so that the T-72 displays the same tendency to brew up.

The T-80's turbine engine may create additional vulnerabilities: lack of fuel commonality with the rest of the Soviet Army, increased thermal signature, the impossibility of evacuating crewmen on to the rear deck, and increased fuel consumption. Conversely, the excellent acceleration that the turbine will provide will reduce vulnerability. The increased maintenance requirements of these tanks must also be considered a vulnerability.

The positioning of the ammunition in any type of Soviet autoloader makes these tanks vulnerable to catastrophic kills if the blast of an anti-tank mine penetrates belly armour.

Obsolescent tanks

T-34/85 Considered by many to be the finest tank of the Second World War. The Soviets still take the trouble to maintain stocks of T-34/85s for export and to produce 85mm ammunition. Those overhauled for export feature new T-55-style road wheels, infra-red driving lights and in many cases, uprated engines. Such tanks have seen action in Angola. It is possible that they may be used in Soviet mobilisation-only formations and for training, or in DOSAAF. T-34/85s are used by the DRA Army.

Weight 32,000kg **Length** 8.1m **Width** 3.05m **Height** 2.7m **Track** 2.45m **Clearance** 0.4m **Ground contact** 3.85m **Engine** V-2-34M 500hp water-cooled V-12 diesel **Speed** 55km/h **Range** 300km **Ground pressure** 0.83kg/cm² **Trench** 2.5m **Verticle obstacle** 0.73m **Slope** 37° **Ford** 1.3m **Armour** 45mm @ 60° (glacis), 45mm @ 20° (upper hull side), 75mm curved (mantlet) **Gun** 85mm ZIS-S53 M-1944 **Elevation/depression** +25°/−5° **Ammunition** 50–60 rounds, other data as D-44 AT gun **Secondary armament** Box and coaxial 7.62mm DTM machine guns **Crew** 4 (5 in company command tanks)

T-10M heavy tank The later version of the T-10, first introduced in 1957, has a multi-baffle muzzle brake, night driving equipment, infra-red optics, two-plane gun stabilisation and snorkelling capability, which the T-10 lacked, and a 14.5mm anti-aircraft machine gun instead of a 12.7mm. T-10Ms spent most of their career in independent army-level tank battalions. According to most sources they were withdrawn in the early 1970s, but US Army estimates showed 300 soldiering on as late as early 1986. If this is the case, some may still be in use.

Weight 52,000kg **Length** 10.6m **Width** 3.566m **Height** 2.43m **Track** 2.6m **Clearance** 0.43m **Track width** 0.72m **Engine** 700hp water-cooled V-12 diesel **Speed** 42km/h **Range** 250km **Ground pressure** 0.78kg/cm² **Trench** 3m **Vertical obstacle** 0.9m **Slope** 32° **Ford** 1.2m **Armour** 120mm @ 60° (glacis), 80mm @ 45° (upper hull side), 250mm armour basis (mantlet) **Gun** 122mm tank gun **Elevation/depression** +17°/−3° **Ammunition** 30 rounds **Secondary armament** one 14.5mm co-axial, one 14.5mm anti-aircraft machine gun

All vehicles of the JSU, JS and SU series have definitely left Soviet service, the last leaving in the 1970s. Some of these vehicles were scrapped – and the Soviets rarely scrap weapons. They remain in service in a number of armies, however, including that of Syria.

Foreign usage

The T-54 and T-55 are still standard main battle tanks throughout the non-Soviet Warsaw Pact countries, although they are steadily being replaced by the T-72: Czechoslovakia (3,100), East Germany (2,300 plus 1,000 stored war reserves), Hungary (1,500), Bulgaria (1,800), Romania (1,300, including indigenous production), Poland (3,200). Other users include: Afghanistan (450 pre-war; there have since been extensive losses and reinforcements), Albania (15), Algeria (300), Angola (150, minus substantial losses), Benin (4), Central African Republic (4), Congo (17), Cuba (400, of which a number

are deployed overseas), Egypt (850), Ethiopia (500), Finland (150), Guinea (25), India (950), Indonesia*, Iran*, Iraq (700), Israel (450 T-1967s, many re-exported), North Yemen, North Korea (1,500), Libya (2,000), Mali (25), Mongolia (100+), Morocco (27), Mozambique (150), Nicaragua (190), Nigeria* (80), Peru (250), Somalia* (100), South Africa (10+), South Yemen, Sudan (130), Syria (800), Tanzania, Togo (2), Uganda* (10), USA (T-54 only), Vietnam (250), Yugoslavia (900), Zambia (70), Zimbabwe (20+).

Countries indicated with an asterisk now probably have none operational. Many others have reduced numbers.

The T-62 was not adopted by any Warsaw Pact army (with the possible exception of Bulgaria, with 100). Other users include Afghanistan, Algeria (350), Angola (82), Cuba (160), Egypt (750), Iran, Iraq (1,600), Israel (150), North Korea (200), Libya (750), Mozambique, Somalia* (30), Syria (500), USA.

The T-64 and T-80 are used only by the Soviet Union.

The T-72 is entering service with the Pact nations – East Germany (100+), Czechoslovakia (150+), Hungary (80+), Romania (30+), Poland (400+) Bulgaria (20+) – replacing T-54/55s throughout the late 1980s. Other users include: Algeria (100), Angola, Central African Republic (4), Congo, (25), Cuba, Ethiopia (40), Finland (50), India (70+), Iraq (c200), Syria (600), Yugoslavia (50), USA (2).

Chapter Nine

Armoured personnel carriers and infantry combat vehicles

"Infantry is the nerve of an army."

FRANCIS BACON, VISCOUNT ST ALBANS

Motorised rifle units are the most numerically important of Soviet combat units. Functioning as part of a combined-arms force, they destroy enemy resistance in the main battle area, creating the opportunity for exploitation by tank units and other motorised rifle units, especially those equipped with BMPs. In addition, motorised rifle units, especially BMP-equipped battalions and smaller sub-units, are seen as being an ideal force to carry out the "daring thrusts" of forward detachments and *reydy* that the Soviets believe will unlock the enemy defence at the tactical level, and as part of the operational manoeuvre groups and other mobile forces that will try to do the same at the operational level. Like all Soviet units, motorised rifle units now place a higher value on manoeuvre and surprise. They are also committed to the high-speed offensive in both nuclear and conventional operations, and have been ever since the motorised rifle troops replaced the infantry in the years 1954–63.

The motorised rifle division is the main striking power of the combined-arms army, and at least one normally forms part of each tank army. A front will normally have two or more combined-arms armies in its first echelon, and each army's first echelon could consist of two motorised rifle divisions advancing abreast over a 20–80km frontage. At least one other motorised rifle division could be kept in the second echelon of the combined-arms army, as is the motorised rifle division in the tank army. All of this assumes a two-echelon deployment, which is by no means mandatory or even to be expected in operational formations. In fact most motorised rifle divisions could easily be deployed on-line if the attack required multiple, smaller axes of advance over all the formation's frontage.

In the defence, motorised rifle divisions are used to hold ground whenever possible, releasing tank units to counter-attack and resume the offensive. In addition to operating as part of an army or an independent corps, motorised rifle divisions will operate independently when opposing weak or isolated enemy units or acting as the front reserve. They could also be used as operational manoeuvre groups at front level. Though more suited to the breakthrough attack and sustained combat than the tank division, the motorised rifle division will still burn itself out faster than Western formations. The divisional logistical base is supposedly adequate for six days of combat, although this may be an optimistic figure in the intense fighting of any future war in Europe.

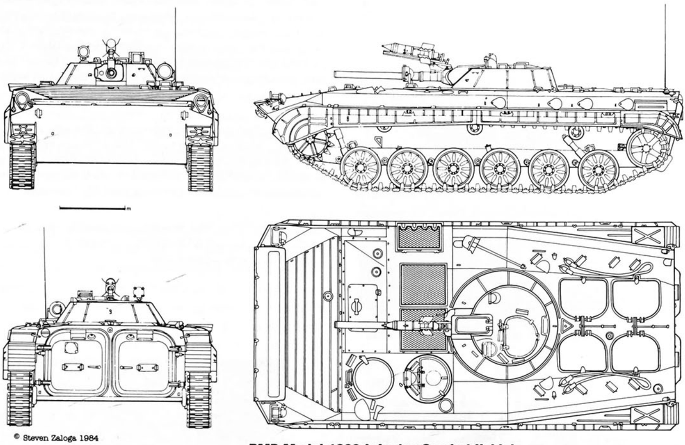
A motorised rifle division marches in the standard formation, with both its wheeled APC-equipped regiments as the first echelon. If required, the BMP-equipped regiment will also be placed in the first echelon. Normally, the BMP regiment remains in the second echelon, and the division can draw its forward detachments and *reydy* from it, and from the independent tank battalion, without weakening the power of the first echelon. The independent tank battalion often serves as the division's reserve. The anti-tank battalion is the anti-tank reserve, both in the attack and the defence.

Motorised rifle units and sub-units represent the norm of Soviet operations and tactics, and standard offensive and defensive concepts all apply.

The future

The Soviets embraced the concept of the APC and the IFV some years after they had recognised the value of the tank, and are in some ways behind schedule in deploying these vehicles. While the tank numbers required by the Soviet Army organisation had been attained by the 1970s, the full complement of extra APCs and IFVs demanded by the increased emphasis on combined-arms tactics at that time could not be deployed in spite of increased production.

There are two lines of Soviet APC/IFV development: the BTR-152, BTR-60, BTR-70 and BTR-80 wheeled vehicles, and the tracked BTR-50, BMP-1 and BMP-2. One design bureau (Dedkov) and one factory (Gorkii)



BMP Model 1966 Infantry Combat Vehicle

Parading in Red Square, BMP-2s armed with smoke mortars, Spandrel and 30mm cannon. *(Jane's Armour and Artillery)*

have been pre-eminent in the production of wheeled vehicles.

The BTR-60/70/80 line of wheeled APCs seems likely to remain in service for the remainder of the century, although the basic design may be approaching the end of its development life. The successor to the BMP/BMP-1/BMP-2 series of infantry fighting vehicles will probably follow the same basic pattern as the BMP-2, with a 30mm or similar cannon. It will probably have an improved diesel engine and may be somewhat larger. The basic tracked vehicle is the MT-LB. It performs tractor and specialist roles primarily, although it is also used as an APC. It is likely to remain in use for the foreseeable future, although a larger follow-on is possible.

Combat in Afghanistan

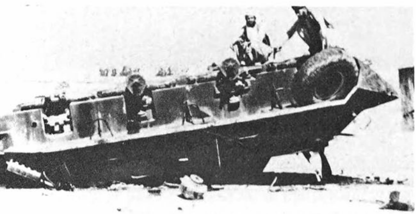
Motorised rifle troops are at the heart of the Soviet war effort in Afghanistan. Since they first crossed the border in December 1979 to link up with the airborne forces and *Spetsnaz*, motorised rifle troops have been involved in every Soviet Army action in Afghanistan. While motorised rifle battalions have, especially after 1984, provided heliborne forces, they have operated mainly in BTR-60PB/70/80

BTR-70 convoy escort. This form of spare wheel mounting is common in Afghanistan.

Left: A BMP-2 of the 70th Motorised Rifle Brigade near Kandahar, Afghanistan, showing the long 30mm gun barrel and the forward machine gun port for the trooper who sits in what was the commander's position on the BMP-1. The 70th has the best reputation for fighting of all the Soviet motorised rifle formations in Afghanistan. *(Committee for a Free Afghanistan)*

Below: Afghan guerrillas examine a BMP which has exploded, blowing off its turret. The Afghans report that because there is so much fuel and ammunition in close proximity in a BMP an RPG hit will often result in an explosion or intense fire. *(Committee for a Free Afghanistan)*

Bottom left: BTR-60PB knocked out by a landmine in Afghanistan. Mined BTR-60PBs often catch fire. *(Jamiat-e-Islami Afghanistan)*



APCs and BMP-1 and BMP-2 IFVs. This has contributed to the roadbound nature of much of Soviet offensive tactics in Afghanistan.

Tactical adaptation to Afghan conditions by the motorised rifle formations has taken a number of forms. Individual marksmanship, small-unit tactical training, and soldier skills were all found wanting in the opening campaign. Fire discipline was poor. Subunits frequently blazed away until they were out of ammunition, and displayed a marked reluctance to dismount from their vehicles. This applied not only to the forces deployed for the invasion and in the following three to six months – when the motorised rifle divisions were full of reservists,

many of them Central Asians with little training or motivation – but throughout much of the war until about 1984.

Motorised rifle units suffered a number of early-war defeats, especially in 1980. Platoons or pairs of vehicles were sent out to escort small convoys, forming targets big enough to draw the Resistance yet lacking the strength to avoid being overrun. While convoy escort has remained a primary – if not the primary – mission of motorised rifle troops in Afghanistan, by the end of 1980 the Soviets had started to consolidate convoys and escorts whenever possible.

Until about 1984 the motorised rifle units were hindered by the fact that they received most of their new personnel untrained, unlike the airborne units. This contributed to the limitations of their tactics. In the early years of the war motorised rifle troops would stay unaggressively with the convoy, often driving through the kill zone and firing through the gunports instead of dismounting and attacking with the BMPs or BTRs in direct support, as Soviet tactics require. They would not counterattack to retrieve lost trucks, preferring to draw off to a distance and shell them.

In the first years of the war motorised rifle outposts tended not to engage obvious Resistance targets of opportunity. This led to situations in which, for instance, Resistance supply convoys could travel unmolested practically within sight of the Bagram air base perimeter.

When operating in combined-arms mechanised offensives, motorised rifle forces have proved unable to surprise the Resistance, largely because their columns move more slowly than Afghans on motorcycles or even in buses. While the Soviets try to use multiple axes of advance whenever possible, most of their opposed advances move slowly, following preparatory bombardments, instead of exhibiting the speed, surprise, and bold and decisive manoeuvre which they regard as the key to victory in a war in Europe.

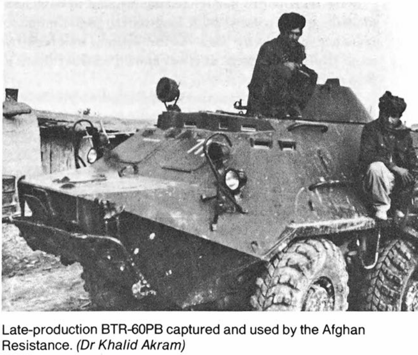
One aspect of the adaptation of Soviet motorised rifle units to the Afghanistan war is an increased emphasis on low-level dismounted tactics, although this takes the form more of better execution of existing methods than a search for new approaches. Marksmanship and physical training have also received more attention throughout the Soviet Army. The re-emergence of Russian-language tuition for non-Russophones, which had not been included in formal training since 1967, may have been due in part to problems with the predominantly Asian units in Afghanistan. Since 1984 training for Afghanistan has become more thorough in general.

Afghanistan has also prompted changes in organisation and tactics. To counter the large number of Lee Enfield-armed Afghans, the Soviets increased (probably threefold) the number of SVD sniper rifles in each motorised rifle company, concentrating them in an anti-sniper squad. By 1984 BTR-equipped companies had been reinforced with platoons armed with 12.7mm NSV machine guns on lightweight tripods to provide a source of heavy firepower that is not tied to the roads. The increased use of AGS-17 grenade launchers, RPG-7, RPG-16 and RPG-18 portable rocket launchers by motorised rifle troops is a reaction not only to the need for dismounted firepower but also to the more advanced weaponry and greater competence of the Resistance.

The re-emergence of mountain troops is another Afghanistan-inspired development. The Soviets now recognise that mountain tactics require a degree of training and specialisation. The pre-Afghanistan solution – the garrisoning in mountainous areas of a few motorised rifle divisions with specialised equipment and training – soon proved inadequate. Despite a wealth of combat experience dating from Tsarist times, Soviet mountain equipment, techniques and tactics were found wanting. As a result, units of battalion size, possibly larger, have received intensive training in mountain warfare and have been issued with climbing equipment. Not all of these units were motorised rifle: airborne troops are seen as good candidates for mountain specialisation.

The BTR-152 was the standard APC of the Afghan (DRA) Army at the start of the war. One regiment per division was supposed to be mobile in APCs, though this level of equipment was frequently not reached. Starting in 1979, large numbers of BTR-152s have been destroyed by the Resistance. Their open tops make the troops aboard vulnerable to long-range Lee Enfield fire, and their mobility on the roads and tracks of Afghanistan is limited. By 1984–86, BTR-60PBs had replaced most of the BTR-152s lost in action, although some are still used, particularly for defensive tasks.

The BTR-60PB is the most extensively used AFV in Afghanistan. Along with the BTR-70, it equips the Soviet motorised rifle divisions, and several hundred examples



Late-production BTR-60PB captured and used by the Afghan Resistance. *(Dr Khalid Akram)*

have also been delivered to the DRA military. It equipped the motorised rifle regiments used in the invasion, and since then has been used throughout the war. Applications include mechanised operations, defence and security, reconnaissance, and convoy escort. In some of these roles, especially convoy escort, it does not necessarily carry motorised rifle squads. The main armament has a higher elevation than those of tanks or BMPs, but has still proved inadequate in many situations arising in action in Afghanistan.

The BTR-60PB has proved relatively reliable in Afghanistan, although this may have been because in 1980–83 the force was largely kept in vehicle parks, deploying only for operations or training. A diplomat who was in Kabul at the time of the 1979 invasion recalls counting a full-strength BTR-60PB-mounted battalion rolling into town with no vehicles missing or being towed.

The BTR-60PB's limited off-road mobility has kept the Soviet forces in Afghanistan road-bound. BTR-60PBs have often become stuck or ditched even on secondary roads, and especially in fords. In the spring of 1980 a BTR-60PB-equipped Soviet battalion advanced on a secondary road in Paktia and was badly cut up, one company apparently losing most of its strength after the road behind it was cut. Bad weather ruled out helicopter support, and the motorised riflemen blazed away from the gunports of the BTR-60PBs until they ran out of ammunition.

While all the motorised rifle divisions committed to the war had BTR-60PBs at the start, a large number of these vehicles have been replaced by BTR-70s. Used in the same way as the BTR-60PB, the BTR-70 has a main armament with increased elevation, and a variety of additional systems, including an AGS-17 on a turret-top mount. The 56th Air Assault Brigade also operates some BTR-70s and BTR-60PBs, as does the 103rd Guards Airborne Division.

Some BTR-60PBs in Afghanistan are said to have had machine guns replaced by a long-barrel 30mm grenade launcher, possibly the same as the weapon mounted by some Hip-E helicopters. It is not known whether this is a field modification.

The first BMPs to see action in Afghanistan were those of the DRA Army which ordered enough for a 20–30–BMP battalion in each of its three armoured brigades. Engaged in heavy fighting in the early years of the war, most DRA BMPs had been lost or worn out by 1982. It is not known whether the Soviets have replaced them. At least two ex-DRA BMPs are in the hands of the Resistance, being operated by their defecting former crews, although the shortage of diesel fuel and main-gun ammunition has limited their use.

The BMP has seen fairly widespread use in Afghanistan since the 1979 invasion. It is likely that most if not all of the motorised rifle divisions had BMP regiments from the start or had received them by mid-1980. It is also likely that some if not all of the invading tank regiments had no organic BMPs, a conclusion prompted by reports of tank units operating without motorised rifle support.

One of the most effective users of the BMP in Afghanistan is the Khandahar-based 70th Motorised Rifle Brigade. Known for its aggressive convoy escort tactics, it received a battalion of BMP-2s in 1982–83. In 1985–86 BMPs were used in *reydy*, normally targeted against Resistance supply convoys.

BMPs have been used for a wide variety of tasks in Afghanistan: as an IFV in support of combined-arms mechanised forces; as a convoy escort, in which role it is sometimes operated as a light tank, without its motorised rifle squad; and to defend positions such as bridges or bases.

The limited elevation of the BMP's turret armament makes it hard to engage targets on high ground. An AGS-17, mounted on the turret roof like the Spandrel ATGM, is carried, as is Sagger, which has been fired from BMP-1s to destroy stone houses near Mazar-e-Sharif.

Unit organisation

Motorised rifle squad (BMP-equipped)
One sergeant with an AKMS, two PKM machine gunners, one RPG-7 gunner, four riflemen with AKMS. Two riflemen serve as assistant machine gunners and one as assistant RPG-7 gunner. The squad is mounted in a BMP with a two-man crew (driver and gunner). In units using 5.45mm-series infantry weapons, the AKMS are replaced by AKS-74s and the PKMs by RPK-74s. The RPG-7 is being replaced by the RPG-16. A squad will carry two, three or more RPG-18s. Squads in Afghanistan may have one SVD rifle each.

Motorised rifle squad (BTR and early BMP-equipped)

As above, with the two PKM gunners replaced by one RPK light machine gunner and one AKMS-armed rifleman. There is also only one assistant machine gunner. A PKM machine gun was added to each BTR-60PB-mounted squad starting in 1979–80. The 5.45mm AKS-74 and RPK-74 weapons have replaced 7.62mm weapons in most Category I units. A BTR-60PB-mounted squad now consists of driver and gunner (with AKS), one PKM gunner, one RPK (7.62mm or 5.45mm) gunner, one RPG-7 or RPG-16 gunner, and five riflemen, including the squad leader and assistant gunners for the two machine guns and RPG. It is uncertain how widespread the issue of PKMs to these squads has been, though it is probably limited in the interests of ammunition commonality. It is likely that most BTR-mounted squads using 5.45mm weapons have two RPKs instead. BTR-60/70/80-mounted squads use basically the same organisation. In Afghanistan there may be one SVD rifle per squad.

These squad organisations are the norm, but variations with eight to twelve men and one or two machine guns have been observed.

Motorised rifle platoon

Comprises three squads and a platoon commander, normally a second lieutenant, although a *praporshchik* or sergeant is often substituted. In addition, one rifleman uses an SVD sniper's rifle rather than an AKMS.

Motorised rifle company

Comprises three platoons and a company headquarters of company commander (usually a senior lieutenant), political officer (*zampolit*, usually a second lieutenant) and technical officer (usually a second lieutenant, often a *praporschchik*), a section of three SA-7/14 gunners (one sergeant, two privates, also armed with rifles), a first sergeant with a rifle, a messenger/clerk and a rifleman/aidman, both armed with LMGs. In addition, there is the two-man crew of the company headquarters' BMP or APC, to make a total company strength of six officers and 96 enlisted men. In combat all of a motorised rifle company fights; it has no support elements. The company headquarters is turned into a combat squad. The three SA-7/14 gunners, political officer, technical officer and first sergeant are each attached down to platoons, one SA-7/14 and one of the command personnel to each platoon. In return, each platoon sends two riflemen to the company HQ under the command of the company commander, making it an effective fighting unit. Each platoon and company commander has one R-126 radio set, which he carries himself. The SA-7/14s are organic to battalion and attached to company level. Each BTR-equipped motorised rifle company also has two AGS-17 grenade launchers which can be fired from tripod or vehicle mounts. The weapons squad in a BTR-mounted company consists of seven men in one BTR with two AGS-17s, all except the AGS-17 gunners and the BTR driver also having rifles. In Afghanistan a company's SVD-armed snipers can be concentrated in one squad.

Heavy weapons began to be added to motorised rifle companies in the 1970s, starting with the AGS-17. It has been reported that rifle companies in BTR-equipped battalions in GSFG, other groups of forces, some of the western military districts, Afghanistan and other high-readiness commands have:

One HQ squad (10 officers and men, 1 BTR, 1 RPG-7/16, 8 AKS-74s)

Three platoons (each of 30 officers and men, 3 BTRs, 3 RPG-7/16s, 6 RPK-74s and 23 AKS-74s, all divided between three squads)

One weapons platoon (20 officers and men, 2 BTRs, 3 Spigot manpacks, 4 12.7mm NSV HMGs [tripod-mounted], 6 AKS-74s)

Rifle companies in BMP-equipped battalions in similar areas are now reported to be 110-strong, comprising:

One HQ squad (10 officers and men, 1 BMP-1/BMP-2, 1 RPG-7/16)

Three platoons (each of 30 officers and men, 3 BMP-1/BMP-2, 3 RPG-7/16s, 6 RPK-74s)

One weapons platoon (10 officers and men, 2 BMP-2s)

Motorised rifle battalion

Total strength: 455 officers and men (BTR-equipped), 432 officers and men (BMP-equipped)

One battalion HQ (six officers: one battalion commander [usually a major, sometimes a captain or lieutenant-colonel], one battalion chief of staff [usually a captain], deputy battalion commander for political affairs [captain or lieutenant], deputy battalion commanders for technical affairs [captain or lieutenant]. Eight enlisted men: one battalion sergeant-major, who is usually with the rear CP, one GAZ-66 driver, one NBC detection technician, two company clerks, one gunner and driver for commander's BMP or APC, one driver for chief of staff's vehicle [all with AKMs]. One GAZ-66 truck, one APC or BMP, one

Left: A BMP-1 on convoy escort duties in Afghanistan, photographed from the vehicle following it in the convoy. The presence of a large crate on the rear deck, blocking the field of fire, suggests that a motorised rifle squad is not being carried and that the BMP is being employed as a light tank, apparently a common practice in Afghanistan. The crew is riding on top, which indicates that opposition is not anticipated. Lee-Enfield-armed Afghans can often be quite adept at picking off such targets at ranges of 800m or more. *(Committee for a Free Afghanistan)*

BRDM-2, BRDM-1, ACRV-2, BTR-60, BTR-50, BMP-ShU or other "U" or command version, one GAZ-69 or UAZ-469 [for battalion commander], one R-126 radio)
Three motorised rifle companies
One mortar battery (5 officers, 56 enlisted men, 14 pistols, 37 AKMs, 6 RPG-7s, 6 120mm mortars, 7 GAZ-66 trucks or MT-LB APCs, 1 GAZ-69 jeep)
  One headquarters and headquarters platoon (one GAZ-69, one GAZ-66 or MT-LB, one battery headquarters [1 officer, 2 enlisted men], one platoon HQ and FO/reconnaissance section [1 officer, 5 enlisted men, 1 rangefinder], one communications section [5 enlisted men, 5 field phones], one transport section [8 enlisted men])
  Three mortar platoons (each of one commander and two mortar squads of two mortars towed by GAZ-66s or MT-LBs each)
One communications platoon (1 officer, 13 enlisted men, 2 command vehicles, 1 motorcycle, 1 GAZ-66, 1 GAZ-69, 1 R-104M, 2 R-105/R-147, 2 R-113/R-123, 1 R-114, and 1 R-126 radios, 1 switchboard, 10 field phones)
  One platoon HQ (1 officer, 1 enlisted man)
  One radio section (6 enlisted men)
  One wire section (6 enlisted men)
One air-defence platoon (1 officer, 11 men, 9 SA-7/14 launchers in three sections) In at least some BMP-equipped battalions, this platoon is reported to have three dedicated BMPs as well.
One grenade-launcher platoon (1 officer, 21 enlisted men, 6 AGS-17s) In at least some units this platoon is reported to have three dedicated BMPs. Does not appear in BTR-equipped battalions
One supply platoon (1 officer, 19 enlisted men, 4 GAZ-66, 4 Ural-375 or ZIL-157, 2 4,000 or 5,000-litre POL trucks, 1 field kitchen, 1 POL trailer, 1 water trailer, 3 kitchen trailers)
  One platoon HQ (1 officer, 1 enlisted man)
  One mess section (8 enlisted men)
  One transport section (6 enlisted men)
  One supply and service section (4 enlisted men)
One medical aid section (1 *feldsherr*, a *praporshchik* barber-surgeon, between a doctor and a nurse in skill; 3 enlisted men, 1 UAZ-450/452 ambulance with trailer. All armed with AKMs)
One repair workshop (7 enlisted men, 1 ZIL maintenance van)
One anti-tank platoon (not in BMP-equipped battalion) (1 officer, 26 enlisted men, 4 Spigots or Suitcase Saggers, 2 SPG-9s, 2–4 RPG-7/16s, 4 BTRs)

The old half-platoon APC organisation was known to be in use in some units in the early 1970s. Squads and platoons were organised as in a BTR-60-equipped unit, but all APCs were held by an APC platoon and attached two to each platoon and one for each company HQ. There was no battalion command APC, jeeps or scout cars being used instead, although current Warsaw Pact armies do have command APCs and anti-tank platoons of Saggers and SPG-9s or recoilless rifles. The old Soviet organisation used 82mm recoilless rifles or 57mm anti-tank guns towed by trucks.

MT-LB-equipped units are organised similarly to BTR-60PB-equipped units, but probably also use MT-LBs to tow mortars. Those units in Siberia and the Far North that use GT-T artillery tractors for APCs have six per company, with the men organised as in a BTR-60PB unit.

MT-LBs are used to tow the 120mm mortars in some BMP battalions, while trucks are used in BTR-60PB battalions and some BMP-equipped battalions.

It has been reported that high-readiness BTR-equipped battalions have, in place of the usual battalion-level organic support weapons:
One mortar battery (30 men, 8 mortars [either 120mm or 82mm *Vasilyek*], 6–8 BTRs or GAZ-66s)
One anti-tank platoon (30 men, 5 BTRs, 6 Spigots, 3 SPG-9s, 4 RPG-7/16s, 8 AKS-74s)
One grenade-launcher platoon (24 officers and men, 3 BTRs, 6 AGS-17s)
One anti-aircraft platoon (30 officers and men, 9 SA-7/14s, 3 BTRs)
One service platoon (20 officers and men, 10 trucks)

Similar BMP battalions (430-strong) are reported to have:
One battalion HQ (1 BMP-1/BMP-2)
One mortar battery (24 officers and men, 6 82mm *Vasilyek* towed by GAZ-66 or MT-LB)
One grenade-launcher platoon (24 officers and men, 6 AGS-17s, 3 BMP-1/BMP-2s)
One air-defence platoon (30 officers and men, 3 BMP-2s, 9 SA-7/14s)
One support platoon (20 officers and men, 10 trucks)

Motorised rifle regiment

Total strength: 2,225–2,315 officers and enlisted men, 23–24 jeeps, 26 POL trucks, 57–66 GAZ-66, 14 ZIL-130/131/157, 47–67 Ural-375, 23–57 KrAZ/ZIL/Ural
One regimental headquarters (28 officers, 32 enlisted men, 4 BRDM-2/U, 1 APC or BMP, 1 command APC or BMP, 4 motorcycles, 3 SA-7/14s, 1 BTR/BMP for Air Force representative, 3 command vans, 8+ jeeps, 3+ trucks)
Three motorised rifle battalions
One tank battalion
One artillery battalion (battery formerly, still in some units)
One anti-tank battery
One *Vasilyek* platoon (25 men, 4 *Vasilyek*, 4 vehicles [BTR in BTR-equipped regiment, GAZ-66 in BMP regiment], 1 command vehicle [BTR or BRDM])
One anti-aircraft battery
One reconnaissance company
One engineer company

One signals company (50 officers and men, three BRDM/BMP/BTR command vehicles, 5 jeeps, 3 GAZ-66, 3 GAZ vans, 2 ZIL signals vans, 3 motorcycles, 2 R-104M, 2 R-130, 1 R-118, 2 HF/VHF [vehicle-mounted, medium-power], 2 HF/VHF [vehicle-mounted, high power], 7 R-107, 2 R-401/5)
One transport company (5 officers, 69 enlisted men, 1+ jeeps, 44+ trucks, 15 POL trucks)
One maintenance company (4 officers, 62 enlisted men, 3 tank recovery vehicles, 1 truck-mounted crane, 2 trucks, 12 maintenance vans)
One NBC defence company (2 officers, 25 enlisted men, 2 NBC reconnaissance BRDMs, 4+ trucks)
One traffic control platoon (1 officer, 19 enlisted men, 2+ APCs)
One supply and service platoon (1 officer, 26 enlisted men, 7 trucks)
One band (1 officer, 16 enlisted men, 1 truck)

In 1986 it was reported that BMP-equipped motorised rifle regiments in tank divisions in Group of Soviet Forces Germany had one tank battalion (40 T-64s or T-80s), two motorised rifle battalions (with a total of 87 BMPs, including those in regimental headquarters), one artillery battalion (24 2S1s), and standard regimental combat support subunits. The BMP-equipped regiments in motorised rifle divisions retain the third BMP battalion and have a total of 130 BMPs, 40 T-64s or T-80s, 24 2S1s and the usual supporting weapons. BTR-equipped GSFG motorised rifle regiments have a total of 145 BTRs in three battalions and regimental HQ, plus battalions of tanks (40) and 2S1s (24) and the usual supporting weapons.

Separate brigades

The Soviets have put more emphasis on the organisation of brigades. These include the brigades that make up the two (possibly more) corps-type tank divisions; the combined-arms brigades that had been subordinated to a number of Soviet divisions by the mid-1980s; and the separate brigades, the best known being that in Berlin and the two in Afghanistan, the 70th and 66th Motorized Rifle Brigades, formed in 1980–81. The 70th was believed to include in 1986–87:
Brigade HQ
One tank battalion
One or two motorised rifle battalions with BMP-2
One or two motorised rifle battalions with BTR-70
One or two air assault battalions
One howitzer battalion
One Grad-1 122mm MRL battalion
Combat support elements
Service support elements
The air assault and BTR-equipped battalions may be dual-role, able to move by either APC or helicopter.

In 1985, when it was committed to the relief of Barikot, the 66th Motorised Rifle Brigade at Jalallabad, Afghanistan, was believed to be organised as follows:
One brigade HQ
One separate tactical HQ for air assault operations
Three motorised rifle battalions
Three air assault battalions
One tank battalion
One reconnaissance battalion
One engineer battalion
One howitzer battery
One BM-21 battery
One medical battalion
One signals battalion
One NBC defence company
KGB "00" detachment (full company)
Special communications detachment
Service support elements
The tank battalion was reported to be attached by companies to the three motorised rifle battalions.

Motorised rifle division

Total strength: 1,163–1,217 officers, 11,608–11,921 enlisted men, 220 [271] main battle tanks, 4 FROG/SS-21s, 18 [72] 152mm SP howitzers, 36 [96] 122mm SP howitzers, 72 [nil] D-30 122mm howitzers, 18 [24] BM-21 MRLs, 24 M-1976 MRLs, 12 *Vasilyek*, 54 120mm mortars (M-1943 or 2S12), 20 SA-6/8/11s, 16 SA-9/13s, 120 SA-7/14s, 16 ZSU-23-4s, 36 [39] ATGM-armed BRDMs, 24 manpack Sagger/Spigots, 12 100mm AT guns, 12 SPG-9s, 598 RPG-7/16s, 54 AGS-17s, 508 RPK-74 LMGs (in units using 5.45mm weapons), 6 Hoplites, 6 Hips, 6 [8] Hinds (in divisions with a helicopter squadron), 11 [24] BMP/BRDM/BTR command vehicles, 7 [19] BRMs, 132 [142] BMPs, 247 [290] BTRs, 4 air control BTR-60PAs, 8 PRP-3s with Small Fred, one SP Big Fred, 14 MT-LBs (more if used to tow mortars), 28 [29] BRDM scout cars, 25 ACRV-2s, 175 GAZ-69/UAZ-469 jeeps, 349 GAZ-66s, 256 ZIL-130/131/151/157, 372 Ural-375s, 1 KrAZ-214/255, 373 KrAZ/ZIL/Ural/KamAZ trucks, 90 GAZ vans, 74 ZIL/Ural vans, 24 ZIL signals vans, 160 ZIL maintenance vans, 2 UAZ-452 command vans, 21 kitchen vans, 4 ATGM simulator vans, 9 hospital vans, 4 bakery vans, 1 generator van, 236 POL trucks, 35 ARS-12/14s, 14 DDA-53/66s, 2 TMS-65s, 10 DKVs, 29 BRDM-2rkh/RKhM, 2 UAZ-469rkh, 24 LuAZ-450/452 ambulances, 29 water tank trucks, 2 KrAZ-214/255 tractors, 10 K-61 cranes, 8 Ural-375 crane trucks, 10 E-305V crane shovel trucks, 11 dump trucks, 2 ZIL-157 recovery trucks, 1 sawmill truck, 1 water purification truck, 3 DIM mine detectors, 15+ missile reload carriers (dependent on SAM type), 15+ missile transloaders, 6 staff cars, 40 motorcycles, 20 ARV-Ts, 4 FROG/SS-21 reload carriers, 3 MTP ARVs, 1 AT-S tractor, 2 IMRs, 6 AVLBs, 24 TMMs, 6 GSPs, one PMP set, 13 K-61/PTS-Ms, 8 BTM/MDKs, 12 BAT/BAT-M/PKTs, 12 BTU dozer

blades, 2 D-144 graders, 12 PZM bucket excavators, 2 UR-67/77s, 54 KMT-4/6 sets, 18 KMT-5M sets, 1 piledriver set, 3 GMZs, 12 PMR-3s, 10 NDL-10 assault boats, 1 sound-ranging set, 12 battlefield surveillance radars, 1 counterbattery radar, air-defence radars (dependent on SAM used), 9 VHF/UHF signal intercept receivers, 3 HF/VHF/UHF radio DF sets, 4 radar DF sets, 4 R-118 van-mounted HF radios, 19 R-401/405 radio relays, 59 R-104M manpacks, 140 R-126 manpacks, 443 R-107 manpacks

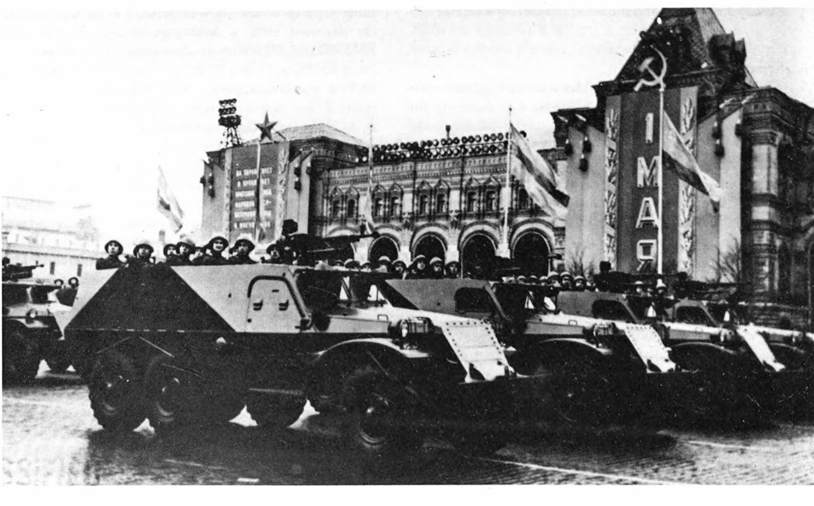
Numbers in brackets show strengths for divisions in GSFG and, probably, other high-readiness divisions in Eastern Europe and the western military districts. These differences reflect the move to 24-weapon artillery battalions and a 51-tank independent tank battalion, and changes in high-readiness motorised rifle regiments. The artillery of these divisions is totally self-propelled; in the other divisions there are two D-30 battalions in the divisional artillery regiment. Other motorised rifle divisions are however significantly weaker, with SP howitzers likely to be absent from lower-readiness divisions. There are not enough BMPs and BTRs to meet the requirements of the table of organisation in full. So, while most divisions have the standard one BMP and two BTR regiments, others, such as those in the Kola Peninsula, use the MT-LB as their standard APC. Motorised rifle divisions that are part of tank armies, as in the case of many in the Byelorussian and Kiev military districts, have more than one BMP regiment. Other, lower-readiness, divisions have no BMP regiment at all, using BTRs (including BTR-50s) instead.

One divisional HQ (245–303 personnel, 6 SA-7/14s, 3 RPG-7/16s, 3 LMGs, 3 BTR command vehicles, 12 jeeps, 28 trucks, two command vans, 9+ armoured command vehicles [in high-readiness divisions at least])

By 1987 several divisions, including at least one in the Moscow Military District and one in Afghanistan, included, as well as the standard four regiments, an organic combined-arms brigade. This includes troops trained for heliborne operations. At the same time, in at least some high-readiness divisions the independent divisional tank battalion had been expanded to an independent divisional tank brigade, probably with at least two tank battalions, one motorised rifle and one artillery.

Three motorised rifle regiments
One tank regiment
One independent tank battalion (at least in Category I divisions)
One artillery regiment
One FROG/SS-21 battalion
One anti-tank battalion
One anti-aircraft battalion
One reconnaissance battalion

BTR-152V2s, shown here armed with 12.7mm DShK heavy machine guns, parade through Red Square. (*US Army*)



Combat support units
One engineer battalion
One signals battalion
One NBC defence battalion (225 personnel, 4 jeeps, 1 GAZ-66, 21 ZIL trucks, 2 vans, 2 maintenance vans, 4 POL trucks, 1 ambulance, 20 ARS-12/14s, 4 DDA-53/66s, 2 TMS-65s, 2 DKVs)
One material support battalion, combining transport and logistical functions (6+ jeeps, 33 GAZ-66s, 30 ZIL-131s, 120 Ural-375s, 9 maintenance vans, 80 POL trucks, other specialist trucks, trailers for all trucks, flexible storage tanks, field refuelling systems)
One maintenance battalion (19 officers, 275 enlisted men, 8+ cranes and tank recovery vehicles, 3+ jeeps, 61+ trucks and vans)
One medical battalion (35 officers, 123 enlisted men, 1+ jeep, 19+ trucks and ambulances)
One traffic control company (3 officers, 57 enlisted men, APCs)
Field bakery
Divisional band
Divisional depots

BTR-152 armoured personnel carrier

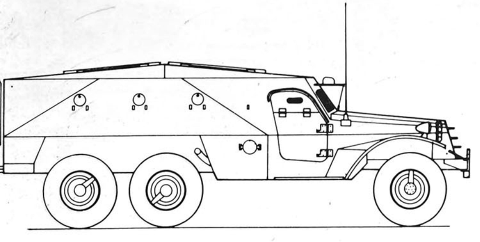
Combat weight 8.95 (9.6) tonnes **Length** 6.83m **Height** 2.05m **Width** 2.32m **Track** 1.742m (front), 1.720m (rear) **Clearance** 0.295m **Tyre size** 12.00 × 18 **Wheelbase** 3.3 × 1.13m **Max road speed** 65km/h **Fuel capacity** 300 litres **Max road range** 650km **Fuel consumption** 0.46 litres/km **Fording** 0.8m **Gradient** 30° **Vertical obstacle** 0.6m **Power/weight ratio** 12.2hp/tonne (11.4) **Engine** ZIL-123, 6-cylinder in-line petrol water-cooled, 110hp @ 2,800rpm **Transmission** 5 forward (with overdrive), 1 reverse 2-speed transfer box **Steering** Wheel-standard **Gun** 7.62mm SGMB or 12.7mm DShK (14.5mm twin ZPU-2) **Ammunition load** 1,250 7.62mm or 500 12.7mm (1,250 14.5mm) **Main gun elevation** −6°/+23.5° (−10°/+90°) **Traverse** 90° (360°) **Armour** 14mm @ 35° (hull front), 9mm @ 7° (hull sides), 9mm @ 0° (hull rear), 4–6mm (nil) (top), 4mm (belly)

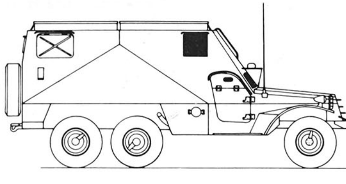
All figures apply to the BTR-152V3 except those in parentheses, which apply to the BTR-152A where it differs from the standard vehicle.

The Soviets produced small numbers of halftracks during the Second World War, and these, along with US and German vehicles, influenced the design of the BTR-152, which appeared about 1950. The basic BTR-152 is a large vehicle without overhead cover, intended to carry or tow heavy weapons or to mount half a platoon of infantry, who dismount over the sides or through rear exit doors, and fire over the sides of the troop compartments or through three side firing ports, which are present in most models.

The engine and chassis were originally those of the ZIL-151 truck, but were replaced during production by those of the ZIL-157, featuring more power and large single tyres. The simple, all-welded steel box body has truck-type windshields for driver and commander which can be covered by steel screens containing a vision block, as can the glassless side door windows. The gearbox has the standard one reverse and five forward gears. Suspension is by leaf springs and hydraulic shock-absorbers. A single 7.62mm SGMB – later replaced by a 12.7mm or 14.5mm gun – is pintle-mounted on the cab roof. Another machine gun is sometimes mounted on the hull sides. Basically an armoured truck, the BTR-152 lacks amphibious capability and has limited off-road capability.

The basic BTR-152 (Model A) had no tyre pressure regulation device or rear winch, while the BTR-152V1 (Model B) had both. BTR-152V2s were BTR-152s with internal air lines for a tyre pressure regulation system added. The BTR-152V3 (Model C) had internal air lines, a winch and infra-red driving lights. The BTR-152K, which appeared in 1963, after production had ceased, was a BTR-152V3 with an armoured roof. The forward exit


BTR-152K with overhead armour (not to scale). (*US Army*)


BTR-152U command vehicle (not to scale). (*US Army*)

BTR-152A self-propelled anti-aircraft mount, also designated BTR-ZPU in the Soviet Union. (*US Army*)

hatch had one firing port and the rear one had two. The BTR-152U command version had a high, enclosed raised superstructure with multiple radios and a catwalk on top, and was built on a BTR-152V1 or V3 chassis. Power was usually provided by a generator trailer. The BTR-152A was an early self-propelled anti-aircraft gun, mounting a twin 14.5mm ZPU-2. The Egyptians mounted four 12.7mm AAMGs on a BTR-152. A ZPU-4-version, the BTR-152E, was produced in small numbers. BTR-152s armed with ZU-23s were used by the PLO in the 1982 Lebanon campaign. Versions of the BTR-152U command vehicle include the basic high-sided BTR-152B, used by artillery commanders; the BTR-152I, essentially the BTR-152B with air pressure lines; and the BTR-152S, for motorised rifle commanders. A total of over 15,000 were built before production ceased in the early 1960s.

Weapons effectiveness and combat usage

The BTR-152, primarily in the open-top version, was used by the Arabs in the 1967 war. The Israelis upgunned large numbers of captured BTR-152s with 12.7mm and 7.62mm machine guns and they were used by the Border Police. Arab BTR-152s also saw action in various incidents between 1967 and 1973 and in the 1973 War. Other nations which received the BTR-152 include China (where they were produced under licence as the Type 56 APC), North and South Yemen, Somalia, Cuba, the Congo, Cyprus, India, Indonesia, Cambodia, Sudan, Tanzania (Type 56s) and Uganda. The BTR-152 has thus undoubtedly seen much combat in recent years. BTR-152As, apparently fresh from Soviet reserve stocks, were in action in the Ogaden War in 1978. BTR-152s have been extensively used by the DRA Army in Afghanistan and have seen continuous combat in Lebanon.

BTR-152s built on the ZIL-151 chassis shared that truck's maintenance problems and poor cross-country mobility. These shortcomings were reduced, but by no

The BTR-152 has been the standard DRA APC for much of the Afghanistan war, suffering heavy losses. (*Committee for a Free Afghanistan*)

BTR-50PK of the Egyptian Army armed with a 7.62mm SGMT machine gun. *(Egyptian Army)*

means eliminated, in those with the ZIL-157 chassis, which is still crude and underpowered even by 1950s standards. Serviceability and reliability are low, especially in hot or desert conditions.

Tactical employment

The BTR-152, as a half-platoon APC, was used differently from current squad APCs. Half-platoon APCs were designed to follow the tanks behind nuclear strikes or artillery offensives. Mounted attacks were considered possible in some situations, but the infantry would normally have to dismount and form up away from the enemy, and the tanks would then either have to attack at a walking pace or have the infantry ride on their backs, with resultant heavy losses.

The BTR-152 was still in Soviet service in the late 1970s, primarily towing mine planters in regimental engineer companies. Some traffic regulation troops of the commandant's service use BTR-152s, as do DOSAAF and other paramilitary groups.

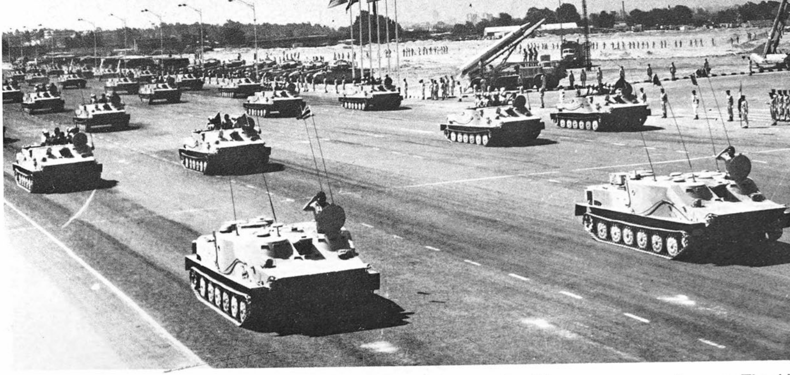
BTR-50 armoured personnel carrier

Combat weight 14 tonnes (14.5) **Length** 6.9m **Height** 1.97m **Width** 3.18m **Clearance** 0.37m **Track** 2.74m **Track width** 0.35m **Ground pressure** 0.52kg/cm² **Max road speed** 44km/h **Max swimming speed** 10km/h **Fuel capacity** 250 litres **Fuel consumption** 0.96 litres/km **Range** 260km **Vertical obstacle** 1.1m **Trench** 2.8m **Gradient** 38° **Power/weight ratio** 16.9hp/tonne **Engine** V-6, 6-cylinder in-line diesel, water-cooled, 240hp @ 1,800rpm **Transmission** Mechanical synchromesh, manual, 5 forward, 1 reverse gears **Gun** 1 12.7mm or 7.62mm SGMB or none **Rounds carried** 500 12.7mm, 2,500 7.62mm **7.62mm elevation** −6°/+23.5° **7.62mm traverse** 90° **Armour** 11mm @ 60° (hull front), 10mm @ 0° (upper hull side), 7mm @ 0° (hull rear), 10mm (hull roof), 6mm (hull floor) **Crew** 2 **Passengers** 12 (18–20 in open-top versions)

All figures are for BTR-50PK except where noted.

The BTR-50 was the first full-tracked Soviet APC. First seen in 1957, production probably having started in 1954, the BTR-50 uses the PT-76's chassis, suspension, engine, power train and water propulsion, with a variety of troop compartments welded to the hull. The driver, seated in the centre of the hull front, has a one-piece hatch cover incorporating a vision block and three periscopes, one of which can be elevated for better vision while swimming. The commander's cupola, on the left, has three vision blocks. An infra-red driving light and searchlight are often mounted.

The initial BTR-50P version was an unarmed, open-top, half-platoon APC, although one or two pintle-mounted 7.62mm SGMBs were later fitted. Anti-tank guns and



Egyptian BTR-50PU command APCs lead a parade. They are recognisable by their additional antennae, generators and power pack on the rear deck, extra cupola, altered hatch arrangement, and ventilators. *(Egyptian Army)*

recoilless rifles could be mounted in the troop compartment by means of the rear loading ramps and could be fired on the move. The BTR-50PA lacked the loading ramps but had a ring-mounted 14.5mm KPV HMG on the commander's cupola. The BTR-50PK was a squad APC with an armoured roof and an NBC defence system, displaying a dome-shaped ventilator. No armament is fitted, although the squad's weapons can be fired through the two roof hatches that serve as the only exit from the troop compartment, or from the one or two firing ports on each side provided on some late-production vehicles. The BTR-50's low freeboard of 0.15–0.20m and its lack of a snorkel in most versions limit its use in all but the calmest water.

The BTR-50 was produced in far smaller quantities than the BTR-152 or BTR-60. APC production ended in the late 1960s, although BTR-50PU and MTP production continued until the early 1970s. About 6,500 were produced.

The Czechs have further developed the BTR-50 design as the OT-62 TOPAS series, adding a more powerful engine, an improved NBC system, and doors on either side of the troop compartments. It has two small front cupolas and is normally unarmed, although the Czech Army's improved OT-62B has a small turret on top of the right-hand cupola. The most advanced BTR-50 version is the OT-62C TOPAS-2AP, which equips the Polish 7th Amphibious Assault Brigade. It has a Czech-designed turret with a 14.5mm KPV and 7.62mm PKT capable of 78° elevation. The Poles have experimented with mounting Saggers on these vehicles. The WPT-TOPAS is a Polish recovery version with a one-tonne-capacity crane. The old Czech 82mm recoilless rifle was often fitted to OT-62s. Command versions of the OT-62 are in service.

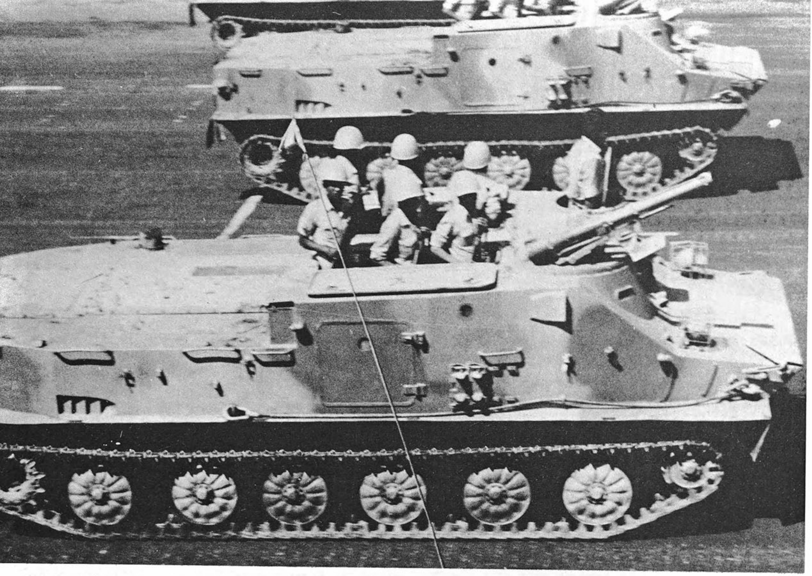
The BTR-50PU, recognisable by its multiple radio aerials and two front commander's cupolas, is the Soviet command version. In addition to the radios, it is fitted with a land navigation system similar to that used in the T-62K. These vehicles are still in many armoured units, although they are being replaced by modified BMPs and ACRV-2s.

A combat engineer version of the BTR-50, firing rocket-propelled line charges to clear gaps in obstacles and minefields, is used by engineer units.

A modified BTR-50PK with four commander's cupolas is used to train tank commanders.

The MTP maintenance and recovery version of the BTR-50PK is an attempt to give Soviet units maintenance capability that can move up to the battle area with the troops. The MTP's cross-country mobility allows it to keep up with tanks, and its NBC protection system means it can cross contaminated areas. The raised roof over the

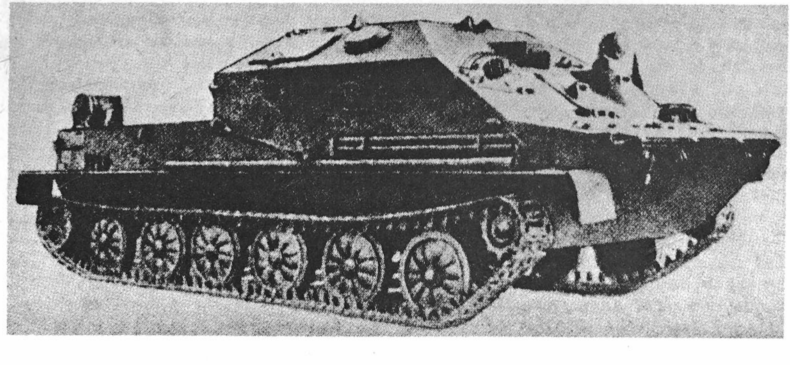
BTR-50PK captured by the Israelis. Its trim vane is extended and the white-light searchlight normally mounted is missing. The two early-model gunports (without NBC protection) are apparent in the troop-compartment sides. *(Tom Woltjer)*

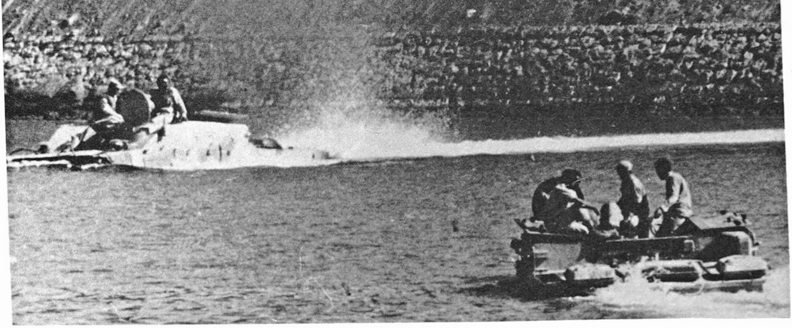


OT-62 TOPAS-2 of the Egyptian Army, showing the Czech 82mm recoilless anti-tank gun and co-axial machine gun mounted on the right-hand cupola and the large side doors that distinguish it from Soviet-built versions. (*Egyptian Army*)

passenger compartment contains a workshop in which technicians can repair components. A recovery hook and anchor with a maximum capacity of 15,000kg is installed. Two firing ports and a PK machine gun are provided for self-defence. There is no lifting crane or large roof hatch, so it would not be possible to bring entire engines into the workshop, though components and modularised systems could be. The MTP also carries a pump for fuelling vehicles and oxy-acetylene welding equipment. The MTP

MTP maintenance vehicle. *(Soldat & Technik)*





BTR-50Ps captured by the Israeli Army. *(Tom Woltjer)*

is important because it brings maintenance specialists to the fighting units, rather than the other way round, and helps to achieve on-the-spot repair and reduce the maintenance problems that the Soviet rates of advance will create.

Weapons effectiveness and combat usage

The BTR-50PK saw action in the 1967 Middle East war, when it equipped the mechanised units of Egyptian armoured divisions along with a number of OT-62s. The Israelis armed their captured vehicles with three 7.62mm machine guns, fired from the troop compartment, and used them in a number of raids into Egypt in the War of Attrition period. BTR-50s and OT-62s were used in Egyptian armoured divisions in 1973. They also equipped the 130th Mechanised Infantry Brigade, which swam across the Great Bitter Lake on October 6 and advanced into Sinai, where it was defeated by Israeli reserves. The Indian Army used several different types of Soviet and Czech-built BTR-50s during the 1971 War. BTR-50s were used in Vietnam.

Tactical employment

The half-platoon versions of the BTR-50 were used in the

BTR-60PB of the US Army, showing the armoured windshield covers and folded trim vane. The machine guns have been removed from this particular vehicle. *(US Army)*

same way as the wheeled half-platoon vehicles. The BTR-50PK still equipped the motorised rifle regiment of some Category II tank divisions in the late 1970s. Some motorised rifle divisions in the USSR were thought to have regiments equipped with the BTR-50 in 1983, and some units may still be so equipped.

BTR-60PB of the US Army, showing the propeller housing (marked with star). *(Leon Conjour)*

BTR-60 armoured personnel carrier

Combat weight 10.3 tonnes (10 tonnes PK, 9.98 tonnes P) **Length** 7.56m (7.2m PK) **Height** 2.31m (2.27m PK, 2.055m P) **Width** 2.825m (2.8m PK) **Track** 2.37m (2.34m PK) **Clearance** 0.475m (0.4m PK) **Tyre size** 13.00 (12) × 18 **Max road speed** 80km/h **Max water speed** 9–10km/h **Fuel capacity** 290 litres (two 145-litre tanks) **Fuel consumption** 0.58litre/km **Road range** 500km (110km water) **Gradient** 30° **Vertical obstacle** 0.4m **Trench** 2.0m **Turning radius** 12m **Engines** Two GAZ-49B 6-cylinder in-line, water-cooled petrol, 90hp @ 3,400rpm **Transmission** Manual, 4 forward, 1 reverse, 2-speed transfer case **Steering** Power, through front four wheels **Main gun** 14.5mm KPV (12.7mm DShKM or nil) **Secondary gun** 7.62mm PKT co-axial (7.62mm PKT, SGMB, or nil) **Ammunition load** 500 14.5mm, 2,000 7.62mm (500 12.7mm, 2,000 7.62mm) **Elevation** −5°/+30° (−6°/+23.5° P) **Traverse** 360° (90°) **Armour** 7mm @ 86° (upper hull front), 9mm @ 47° (lower hull front), 7mm @ 0° (hull side), 5mm @ 65° (hull rear), 7mm @ 40° (nil) (turret, all around), 6mm (nil) (turret top), 7mm (nil) (hull top), 5mm (belly) **Crew** 2 **Passengers** 9–14 (16 P) **Radio** R-123, plus R-107 in company command vehicles **Night vision devices** TVN-2B (60m range) (driver), TKN-1 (250–300m range) (commander)

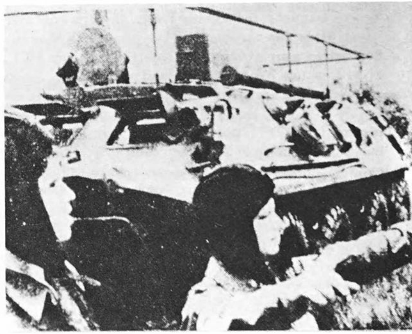
Figures apply to BTR-60PB; those in parentheses are for earlier versions where they differ.

The BTR-60 (BTR = *Bronetransportr*, armoured personnel carrier) is numerically the most important APC in the Soviet Army. Each motorised rifle division has two regiments equipped with wheeled APCs and one equipped with BMPs, while motorised rifle divisions in lower readiness categories may have no BMP regiment and are completely BTR-60 equipped. BTR-60-equipped regiments are normally in the division's first echelon, and the BMP and tank regiments make up the second echelon. Units equipped with the BTR-60 will fight the mobile battles of encounter, or make the breakthrough attacks, before the exploitation forces are committed. While it is an old design, technically unsophisticated and unrevolutionary even when introduced, the BTR-60 is still an important weapons system. The BTR-70 and BTR-80 are product-improved versions of the BTR-60; tactically and technically, the BTR-60PB remains the archetype of Soviet wheeled APCs. About 25,000 were produced, mainly at Gorkii. While the BTR-70 may have replaced it in deliveries to the Soviet Army in the mid to late 1970s, BTR-60PB production for export is reported to have continued into the mid-1980s.

All versions of the BTR-60 feature a long, boat-shaped welded steel hull. All eight wheels are powered by two six-cylinder, rear-mounted petrol engines, their design dating back to the 1930s. The use of petrol was apparently specified in the original requirement. The twin-engine solution and 8×8 drive required a complicated power train, and engine synchronisation has remained a problem. The front four wheels are used for steering. Suspension is by torsion bar, and the steering wheels have two hydraulic shock-absorbers each; the other wheels have one each. All versions have the standard Soviet central tyre pressure regulation system and foam-filled tyres. The manual transmission has one reverse and four forward speeds and a two-speed transfer case.

The BTR-60PB, along with its BTR-70 and BTR-80 follow-ons, is the standard APC of motorised rifle divisions easily identifiable by its small, conical turret with a 14.5mm KPV and co-axial 7.62mm PKT. The troop-compartment roof hatches are rearranged compared with earlier versions, but are still the only, inadequate exits. The driver and commander each has his own side door and roof hatch with tank-type periscopes rather than vision blocks; there is also a periscope on the turret top. Later-production vehicles have three firing ports and a large vision block in each side of the troop compartment. Late-production BTR-60PBs, like the BTR-70 and BTR-80, have a standard periscope in the turret roof. The BTR-60PB has improved NBC protection, although not as complete a system as that used on the BMP. The BTR-60

Above BTR-60PU command APC of a FROG-3-equipped missile unit, showing its raised roof and additional antennae. It is followed by a command version of the standard GAZ-69 jeep. These vehicles are crucial to the Soviet command, control and communications effort. *(Chris Foss)*



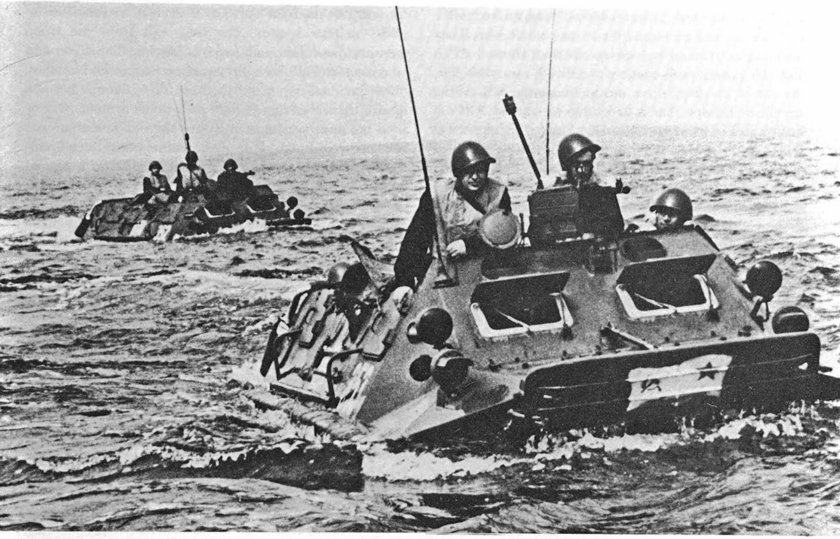
Right: BTR-60PU command APC unit with Clothes Line and High Ball antennas.

ACRV M-1979 is used as a COP in towed-artillery batteries and battalions. The BTR-60PU-12 is a specialised mobile command post for air-defence units and sub-units.

The BTR-60PU command vehicle is a modification of the BTR-60PA with single R-311, R-107, R-112 and two R-123 radios. These systems may be replaced by more modern equipment in some cases, and the precise fit differs according to the mission: a motorised rifle battalion commander's BTR-60PU would have an R-107, R-123, R-126 and R-130; a battalion chief of staff's an R-107, R-123, R-311 and two R-130s; a company commander's standard BTR-60PB an R-107, R-123, and an R-126 for dismounted use. An improved BTR-60PU, in service since the early 1970s, mounts the High Ball telescoping antenna as well as having a clothes-line antenna on the hull.

Beneath a large, tent-like canvas top are a generator and map tables. It is used by the chiefs of staff of BTR-60PB-equipped battalions and as a COP by larger artillery units, acting as the towed-artillery counterpart of the ACRV-2. The forward air control version is found at division level (one per division), or is attached to units that will need air support. It is a modified BTR-60PB with a Plexiglas window replacing the machine guns. A generator is mounted on the rear decking. It apparently carries an R-122 and other ground and aircraft-type radios, but has no radar beacon or blind bombing aid. A long-range communications BTR-60PU version has a 10m aerial and a large railing-style aerial running along three sides of the vehicle's top, which has a large external generator and transmitting gear. This version is also used by the East German Army.

Compared with tracked APCs, wheeled APCs have 45–60% less production cost, 60–80% better fuel consumption, three times the lifespan, three to five times the interval between repairs and overhauls, and greatly reduced maintenance requirements. Wheeled APCs can operate on flat tyres, while a broken track will immobilise a tracked APC. They do not damage the roads upon which they operate and they create less damage during peacetime manoeuvres, although the Soviet Army never pays for damage it causes on manoeuvres (the local government



Above: BTR-60Ps of the Naval Infantry swim ashore through a calm sea, with their trim vanes extended and SGMT machine guns manned. *(Chris Foss)*

Below: BTR-60P with 12.7mm DShK main armament and 7.62mm SGMTs on outrigger mounts. *(US Army)*

does that). Wheeled APCs are lighter than tracked APCs and can use bridges which the latter cannot take. They have higher maximum road speeds than tracked APCs and, while their cross-country mobility is inevitably less, the use of all-wheel drive means that only 10% of the terrain in Europe that is accessible to tracked APCs is inaccessible to wheeled APCs. Considering the number of BTR-60s the Soviets require, the use of wheels is a good idea.

The BTR-60 has good amphibious characteristics, and the BTR-60PB is the standard APC and landing craft of the Naval Infantry. In the water the BTR-60 is powered by a single hydrojet at speeds of up to 10km/h; a bilge pump is fitted and a trim vane under the nose gives stability while swimming. While the BTR-60 is suitable for river crossings as long as the bank exit gradient does not exceed 6–10°, it is inadequate for amphibious assaults. Given a launch 3,000m offshore, their 20min run-in to the beach would be suicidal in the face of any opposition. The BTR-60 can only land through two feet of surf, while the US LTVP-7 assault amphibian can surmount 12 feet.

A turret-armed version, the BTR-60PAI, was apparently the transition between the BTR-60P and the BTR-60PB. The original, 1961, BTR-60P has no overhead cover except a tarpaulin. It has three firing ports, a half-door and a vision block on each side of the troop compartment. Armament varies, most mounting a single 12.7mm DShKM; others have a 7.62mm SGMB in addition to or in place of this weapon. Two more 7.62mm weapons are sometimes placed on outrigger mounts and fired from the troop compartment. This version was replaced by the BTR-60PA with an armoured roof and an NBC defence system. The only exit from the troop compartment is through two roof hatches. The driver and commander both have the usual periscopes and hatches. The pedestal-mounted 12.7mm or 7.62mm has no gunshield and cannot be fired from under armour. One or two 7.62mm weapons are also often mounted at the forward roof hatch. Driver and commander have 8mm-thick armoured Plexiglas windscreens fitted with hinged steel covers, each containing a vision block for use when under fire; these greatly reduce visibility, however. All models have infra-red driving lights and many have infra-red searchlights.

A number of experimental armament installations have been tried on BTR-60s. Turrets with 76mm and automatic 37mm cannon were tried in the early 1960s, perhaps as forerunners of the BMP. A mortar-carrying version of the BTR-60P reached prototype stage, but this vehicle, which allowed the mortar to be fired while mounted, apparently never entered large-scale service.

The BTR-60PB is now the standard version in Soviet service, although older types are known to be in use in first-line roles. In 1987 some Angolan BTR-60PBs mounted two SA-13 SAM canisters.

The Romanian TAB-72 version of the BTR-60PB has a turret with improved elevation; a TAB SP 82mm mortar version lacks the turret.

The vulnerability of Soviet wheeled APCs is not significantly greater than that of the BMP, the former's use of petrol engines being set against the BMP's tendency to explode.

The BTR-60PB's NBC protection is superior to that on US APCs. Its cross-country mobility is excellent for a wheeled vehicle, and US Army-owned BTR-60s regularly outdistance M60 tanks at Fort Hood, Texas. In the words of one US Army officer: "The BTR-60 is great fun to drive – it's the ultimate RV [recreational vehicle]."

BTR-60PA, showing small exit hatches and gunports. Main armament is a 12.7mm DShK. *(US Army)*

Weapons effectiveness and combat usage

The BTR-60 was used in relatively small numbers in the 1967 Middle East war, and the BTR-60PB was the standard Arab APC in the 1973 War. The Israelis do not appear to have adopted captured vehicles. North Vietnamese BTR-60s were first encountered in the Laos invasion. They were used in large-scale attacks in support of tanks at An Loc and in I Corps in 1972, BTR-60Ps predominating. Large numbers of BTR-60s, including BTR-60PBs, were used in the 1975 and later fighting. BTR-60s are also used by Soviet-backed forces in Angola and Ethiopia.

BTR-60PBs have been used throughout the war in Afghanistan, equipping the Soviet motorised rifle divisions that carried out the initial invasion. Since then BTR-70s have supplanted some BTR-60PBs, but they remain in widespread service. The DRA military also uses BTR-60PBs, the Kabul-based 8th Division having substantial numbers. Other divisions have a battalion each, replacing BTR-152s. BTR-60s have also seen extensive combat in Lebanon and the Iran-Iraq war. A few BTR-60PBs were used against US forces on Grenada, being employed as light armoured vehicles rather than APCs – a role they also sometimes perform in Afghanistan – but were soon knocked out by 90mm recoilless rifles. Sandinista BTR-60PBs have been in action against anti-communist guerrillas.

Tactical employment

Earlier BTR-60 versions were used as half-platoon APCs in the same way as BTR-152s and early BTR-50s. The APCs were needed to mechanise the Soviet infantry as quickly as possible – the last "foot" infantry was converted to motorised rifle in 1963 – and the Soviets were willing to tolerate the lack of overhead cover, NBC protection and tactical flexibility just to get the troops on wheels.

The two BTR-60PB-equipped regiments of a motorised rifle division will normally make up its first echelon in both attack and defence.

Vulnerability and countermeasures

To dismount from a BTR-60PB or BTR-60PA, the troops must physically haul themselves out of the two small roof hatches and jump or roll over the side, facing backwards. They will even do this while the vehicle is moving at up to 15km/h, and it is said to be no more hazardous than a parachute landing. To do this requires small, physically tough men and a willingness to accept accidents; the Soviets consider 3% casualties on manoeuvres acceptable.

The petrol carried on the BTR-60 makes it liable to "brew up" if hit. This has earned it the nickname "wheeled coffin" (*kolesniy grab*) in Afghanistan. White phosphorus shells can ignite fuel, especially in external tanks. The tyres are vulnerable, though foam-filled, and a small compressor is part of the air-pressure system. But while these measures are adequate defence against small arms, shell fragments will flatten the tyres.

Armed with a BM-21 40-round 122mm multiple rocket launcher on its forward deckhouse and carrying 11 BTR-60PB APCs on deck, Alligator-class LST "029" is shown participating in the Northern Fleet's 1986 amphibious exercise. The vehicles are likely to be one company's equipment, which would indicate that the Naval Infantry has followed the lead of the Army in adding to each company a BTR-60PB to carry two AGS-17 30mm grenade launchers. The vehicles are marked with the insignia of both the Naval Infantry and the Air Assault troops, possibly to mislead Western interpreters. *(Royal Norwegian Air Force)*

BTR-70 and BTR-80 armoured personnel carriers

Introduced 1976 (1980) **Combat weight** 11.5 tonnes **Length** 7.54m **Width** 2.8m **Height** 2.23m **Track** 2.4m **Ground clearance** 0.47m **Engines** ZMZ-4905 2×6 cylinder petrol, 115hp (V-8 diesel, 260hp) **Fuel** 300litres **Crew** 2 **Squad** 9 **Max speed** 80km/h (85km/h) **Road range** 400km (450km) **Radio** R-123M **Main gun** KPVT 14.5mm with 500 rounds **Co-axial gun** PKT 7.62mm with 2,000 rounds **Elevation** −5°/+30° (−7°/+60°) **Armour** as BTR-60PB except lower front hull (10mm @ 60°), possibly layered armour as well

Figures in parentheses for BTR-80. All other data as BTR-60PB.

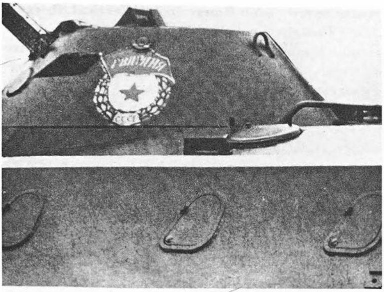
The product-improved follow-on to the BTR-60PB, the BTR-70 features the same armament and basic layout. Probably another Dedkov design, it represents a limited follow-on, retaining most of the features of the BTR-60PB while correcting some of its more apparent limitations: engine power and provision for squad exit.

Introduced in the mid-1970s, the BTR-70 was first seen in 1978 and was designated BTR-M-1978. It was first paraded in November 1980. Its improvements include enlarged troop compartment access, including triangular access doors, amidships on both sides. Internally the BTR-70 is arranged like the BMP, with six squad members, each with a firing port, sitting back-to-back on a bench seat in the middle. Two more squad members – including the vehicle commander – are seated behind the driver and gunner and have side firing ports under the forward hatches. Firing ports have been added to the two roof hatches, but there is still only one vision block on each side in the troop compartment. The roof hatch arrangement has been improved. Some BTR-70s in the November 1986 Moscow parade were fitted with BTR-80-style turrets, capable of 60° elevation.

The twin engines were uprated and maintenance access, a weak point of the BTR-60, improved. The BTR-70 has a slightly lower centre of gravity than the BTR-60PB, which may increase cornering ability. The centralised tyre inflation system has been improved by adding a quick-release system so that rough terrain can be crossed without losing momentum. The BTR-70 also introduced an

Above: BTR-70 of the East Germany Army, which designates it the SPW-70. The BTR-70, like the BTR-80, has its side firing ports angled upwards.

Right: BTR-80. *(US Department of Defence)*



BTR-80-style turret mounted on BTR-70. *(US Army)*

automatic engine-compartment fire extinguisher. Part of the hull armour has an increased slope and may incorporate layered armour.

A forward air controller version of the BTR-70, similar to that of the BTR-60 series, has been seen in Afghanistan. The BTR-70PU command version has the same wide range of radio fits as the BTR-60PU. There are also artillery, communications and turretless recovery versions, the latter with a jib crane.

BTR-70s in Afghanistan have an AGS-17 on top of the turret roof. In others a grenade launcher replaces the 14.5mm machine gun. A BTR-70 can carry two AGS-17s and their tripods in the squad compartment.

BTR-70 production stopped in 1982, the line being turned over to the BTR-80. This is another incremental improvement on the basic BTR-60PB. It finally does away with the twin engines, replacing them with a single four-stroke turbocharged liquid-cooled diesel. The amidships hatches on the BTR-70 have been enlarged into full-sized two-part exit doors. The firing ports are angled to permit the squad to fire obliquely forward. The main armament is the same but its elevation capability is doubled. Six smoke mortars are mounted on the turret. Like the BTR-60PB, both the BTR-70 and BTR-80 have a front-mounted winch, NBC system and central tyre pressure regulation.

Above right: A BTR-80 emerges from a river. *(US Army)*

Right: BTR-70s with externally stowed jerricans. In Afghanistan extra ammunition boxes are carried externally to increase capacity, reduce the risk of explosion, and serve as improvised stand-off armour against shaped-charge weapons.

The BTR-80 was in Soviet service in East Germany in 1986. There are unconfirmed reports of a version armed with the 2A42 30mm gun as used on the BMP-2. BTR-80s in Afghanistan have additional stand-off armour plates mounted on spines added to existing armour.

Weapon effectiveness and combat usage

Weapons are the same as those of the BTR-60PB, although the BTR-80's increased elevation gives it a capability against helicopters and targets on high ground. Many BTR-70s and 80s have seen combat in Afghanistan.

Tactical employment

Both vehicles seem to be used in the same way as the BTR-60PB, although a cannon-armed BTR-80 could be a specialist reconnaissance vehicle.

Vulnerability and countermeasures

Squad exit provisions have gradually been improved in both vehicles, but they are still deficient when compared with the MT-LB or Western vehicles. The diesel engine of the BTR-80 may reduce vulnerability to fire.

BMP, BMP-1 and BMP-2 infantry combat vehicles

Combat weight 13.9 tonnes **Length** 6.74m **Height** 1.92m **Width** 2.94m **Track** 2.54m **Ground clearance** 0.39m **Track width** 0.2m **Ground contact** 3.6m **Ground pressure** 0.57kg/cm² **Max road speed** 70km/h **Max water speed** 7–8km/h **Fuel capacity** 460lit (all internal) **Oil capacity** 44lit **Fuel consumption** 0.9lit/km **Fuel consumption (swimming)** 1–1.5lit/km **Oil consumption** 0.05–0.07 lit/km **Range** 500km **Vertical obstacle** 0.8m **Trench** 2.0m **Gradient** 30° **Tilt** 35° **Power/weight ratio** 20.1hp/tonne **Engine** 5D20 V-6, 6-cylinder, in-line, water-cooled diesel, 300hp at 2,000rpm **Transmission** Mechanical constant-mesh with synchro-couplings: 5 forward, 1 reverse gears, 2–5 operated hydraulically, rest mechanically **Steering** Planetary, 2-stage clutch and brake, hydraulically operated **Gun** 2A28 73mm **Calibre length** 19cal **Rate of fire (theoretical)** 7–8rpm **Rate of fire (actual)** 3–4rpm **Effective range** 800m **Max range** 2,200m **Ammunition types** PG-9 HEAT, HE **Muzzle velocity** 400m/sec (HEAT) **Maximum velocity** 665m/sec (HEAT, with rocket) **Ammunition load** 40 rounds **ATGM** Spandrel, Spigot or Sagger **ATGMs carried (max)** 5 total: 4 internal, 1 on launcher **Co-axial MG** PKT 7.62mm **AAMG** nil **7.62mm ammunition** 2,000 rounds **Main gun elevation** −4°/+33° **Traverse** 360° **Turret mechanism** Electro-mechanical **Armour** 7mm @ 80° (upper hull front, excluding aluminium engine cover), 19mm @ 57° (lower hull front), 16mm @ 14° (upper hull side), 18mm @ 0° (lower hull side), 16mm @ 19° (hull rear, excluding inner armour of door), 6mm (hull top), 5mm (belly front), 7mm (belly rear), 33–26mm rounded (turret mantlet), 23mm @ 42° (turret front), 19mm @ 6° (turret sides), 13mm (turret rear), 6mm (turret top) **Crew** 2 **Passengers** 9 **Radio** R-123 or R-123M, plus R-107 in company command BMPs

All figures relate to BMP-1

BMP-2 As above, except:

Combat weight 14.6 tonnes **Crew** 2 **Passengers** 7 **Ground pressure** 0.64kg/cm² **Length** 6.71m **Width** 3.09m **Height** 2.06m **Maximum road speed** 65km/h **Water speed** 7km/h **Range** 600km **Vertical obstacle** 0.6m **Trench** 2.5m **Smoke launchers** two triple mounts **Main armament** 2A42 30mm **Rate of fire** 2-300rpm/500rpm (two rates) **Elevation** −5°/+74° **Traverse rate** 35°/sec **Elevation rate** 6°/sec **Ammunition type** AP-T, HE-T (dual feed) **Muzzle velocity:** 1,000m-sec **Ammunition capacity** 500 rounds **ATGM** Spigot or Spandrel **Engine** Turbocharged version of 5D20, 350–400hp **Maximum range** 4,000m **Effective range** 1,000m

"The BMP has not only given the commander swiftness of manoeuvre; it has increased the firepower of tactical units." – Marshal K. Moskolenko
"The search for new and better ways to use the BMP in battle is one of the most important tasks for Army officers." – Colonel-General V. Merimskii
First seen in the November 1967 Red Square parade, and called the M-1967 and BMP-76 by NATO before its correct designation was known, the BMP (*Bronevaya Maschina Piekhota*, armoured vehicle, infantry) is one of today's most significant weapon systems. The first infantry combat vehicle, with cannon and ATGMs in addition to a motorised rifle squad, the BMP brings combined-armed integration to the lowest tactical level.

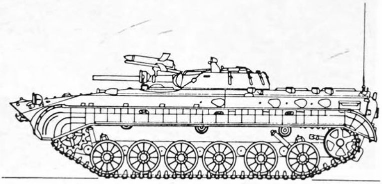
The BMP was designed to an early-1960s specification for an infantry combat vehicle suited to the demands of the high-speed offensive in nuclear war. This specification resulted in *zavodskoe izdeliye* (factory project) 765, nicknamed *Korshun* (kite), and stressed high speed, good armament, NBC protection and facilities for the squad to fight mounted. Mobility was important, as the vehicle had to keep up with a 70–100km/day advance and cross contaminated ground quickly. Speed of advance was seen as a better defence against enemy nuclear targeting than armour plate. Secure in their protected compartment, the squad would seldom fight dismounted. Armour protection was to be similar to that of contemporary APCs.

The armament decision may have proved difficult. Experiments at about this time with the arming of the BTR-60 with 23mm and 37mm weapons, apparently derived from aircraft cannon, suggest that the Soviets were at least aware of the potential of smaller-calibre weapons before deciding to use the 73mm with its tank-killing capability. It is possible that this decision was pushed through by the Main Armour Directorate, thinking perhaps that the biggest threat to armoured vehicles, whether tanks or BMPs, is other tanks.

It is misleading to compare the BMP with Western APCs having lighter armament and a higher silhouette. Not only does the infantry combat vehicle have heavier armament, but the squad fights mounted more often than does that of an APC. The Soviets recognise this distinction between APC and infantry combat vehicle, and use both.

The debate on the proper use of the BMP ceased in the

Above: Motorised riflemen armed with AK-74 5.45mm assault rifles advancing with BMPs. The Sagger sight and the squad's periscopes are apparent on the vehicle on the left.



Left: BMP (first production model).

Below: A BMP-2 (Soviet nickname *Yozh*, "Hedgehog") without smoke mortars traverses an AVLB-positioned bridge.

Soviet open military press after 1976. The Soviet changes in operational and tactical thinking that appeared subsequently seem to have confirmed the importance of the BMP to the Soviet Army. In the early 1970s the BMP, with its ability to carry motorised riflemen cross-country, was seen as a very useful tool for forward detachments or *reydy*. It thus came to be treated as a key part of formations designed to act as operational manoeuvre groups. The divisional BMP regiments continue to be tasked with exploitation at the tactical level, while larger formations will provide operational exploitation. Unconfirmed reports of Soviet divisions with more than one BMP regiment date back to the mid-1970s. Such divisions would be suited to operational exploitation, as part of an OMG or an army or front second echelon. There have also been reports of at least two, possibly more, Soviet tank divisions organised with a number of independent brigades; such formations would use a large number of BMPs.

Development and versions

The pre-production "Model 1966" BMP featured the characteristic short bow and triangular rear-deck air

intake. These vehicles were produced for the 1966 operational trials, the state trials having been passed the year before. There were a number of problems. The vehicle swam badly, the squad compartment filled with gun gas, and while the suspension was intended for high speed – the BMP had a track system similar to that of the new T-64 tank and was the first Soviet AFV to use a simple steering yoke – it proved to be weak.

The first production BMP addressed these problems. It had an extra rocker arm added behind the front road wheel as part of an improved shock-absorber. It also differed from the pre-production models in having the fume-extraction ports for the squad's rifles moved outboard of the hull over the troop compartment; improved torsion-bar hinges for the troop compartment roof hatches; revised swim vanes and fender design; and a PBZ chemical filter system in addition to the standard overpressure NBC protection.

During the production run of the standard BMP the small rear-fender tool boxes were removed and the forward gun ports on each side of the hull were enlarged to accommodate PKM GPMGs. The standard BMP was produced in 1966–69; at least four different versions can be distinguished. Subsequent developments are as follows.

BMP-1

Most of the BMPs produced with 73mm main armament have been BMP-1s. This version entered production in about 1970, featuring numerous minor improvements. To improve swimming, the bow was lengthened by 20cm, a larger trim vane was fitted, and a new air intake capable of taking a short erectable snorkel was mounted behind the turret. The forward PKM gun port was changed to the more familiar "square" shape.

The appearance of a new NBC filter and sensor and the removal of the left forward hull air intake suggested that the BMP-1 had an improved chemical air filtration system. The roof hatches over the troop compartment were altered from a parallel to a "V" arrangement to provide better fields of fire. Many BMP-1 improvements were retrofitted to existing BMPs.

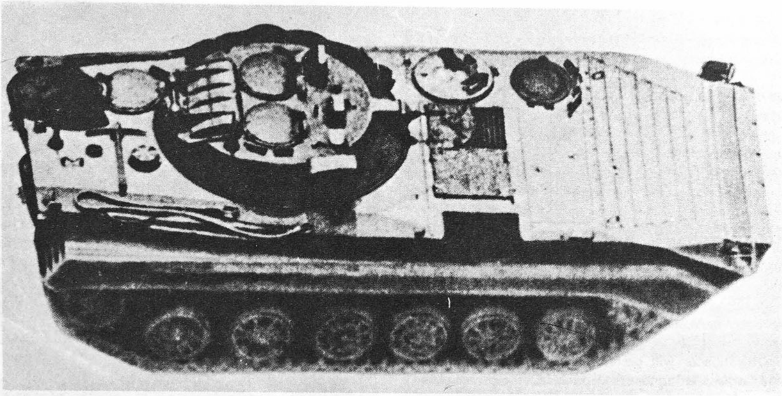
During the early to mid-1970s the introduction of a SACLOS-guidance version of the Sagger ATGM resulted in BMPs and BMP-1s being retrofitted with the new weapon, which also appeared on new-production BMP-1s. The last production BMP-1 version, the BMP-1M of 1974–75, had a Spigot ATGM launcher on the turret top in place of the over-barrel Sagger launcher. Unlike Sagger, Spigot cannot be fired while under armour. The Spigot launcher was later retrofitted to other BMP-1s.

BMP-2

Development of the BMP-2 – originally known to NATO as the BMP M-1980 or M-1981 – probably started in the

Above: DRA Army BMP-1 captured by the Afghan Resistance and used by them in Zabul province. *(Ben Pendleton via Committee for a Free Afghanistan)*

BMP-2E on static guard duties (a common mission for BMPs) in a residential quarter of Kabul. The crew are wearing body armour. *(Wide World)*



PRP-3 radar vehicle, showing folded Small Fred radar at the rear of the turret and 7.62mm PKT machine gun at the front. *(US Army)*

early 1970s, with production starting in the mid-1970s. The BMP-2 is used in the same way as the BMP-1, which it is replacing one-for-one.

An obvious improvement over the BMP-1, the BMP-2 addresses two major limitations in the initial design: the 73mm gun's low rate of fire and the problems of a one-man turret. The BMP-2's 2A42 30mm gun has a longer range (2,000m) than the 73mm and an anti-helicopter capability, although it lacks a lead-computing sight. It has had problems with its feed system. The replacement of Sagger with Spandrel has increased ATGM capability. But while Spandrel can be fired from under armour, its turret-top mounting makes it impossible to reload without opening up. Czech BMP-2s mount Spigot launch tubes, suggesting either that the BMP-2 can fire both missiles or that non-Soviet Warsaw Pact armies will use Spigot instead of Spandrel. The BMP-2 also has six smoke mortars similar to those on some T-72s, three on each side of the turret. In 1985 the Soviets paraded BMP-2s with appliqué armour on their turret sides; this was similar to that on some T-72M1s.

BMP-1K (BMP M-1974)

Company command vehicle, with R-107, R-123 and R-126 radios and a small telescoping antenna on the right rear hull side. Retains gun and ATGM armament. Firing ports and periscopes on right side (and one each on the left side) blanked out.

BMP-Sh

This version serves alongside the BTR-50PU as a CP vehicle of tank units. Mounts a small turret with optical devices and a 7.62mm PKT for self-defence. Features several radio aerials and a modified, raised rear deck. A canvas extension may be used when halted. Presumably also has a generator and a land navigation system.

BMP-1KSh (BMP M-1978)

Battalion and higher-level command vehicle, identifiable by a fixed turret in which the gun is replaced by a large, telescoping Top Ball (perhaps Hawk Eye) communications antenna which can be folded up or down. Other radios include R-107, R-123, R-130 and R-311. It has two rear roof hatches and an extra generator.

PRP-3

The PRP-3 (BMP M-1975) or BMP-SON is the artillery reconnaissance version, equipped with a Small Fred radar (J-band, 20km detection, 7km tracking range), the folding rectangular antenna of which is mounted at the rear of a large two-man turret armed with a 7.62mm PKT for self-defence. Total crew of five men. (See *Signals, Intelligence and Electronic Warfare* chapter for radar details)

BRM, BRM-1 and BRM-2

Specialised reconnaissance versions. (See *Reconnaissance* chapter for details)

BMP mortar vehicle

The mortar may be either on-vehicle (using M113-type ramp) or mounted as a turret gun, as on the 2S9. Development and deployment unconfirmed. May refer to 2S12 120mm mortar.

BMP-PPO

Training version with turret removed and eight roof-mounted cupolas for drivers under instruction.

BMP-1E and BMP-2E

Some of the BMP-1s and, in 1986–88, BMP-2s in Afghanistan have received additional armour to reduce their vulnerability to 12.7mm machine guns and RPG-7s. This consists of extra 6mm steel plates on the hull, glacis and turret, and suspension skirts which may be made of the same fabric-type armour seen on T-72Ms. The BMP-1s may be retrofitted for Spigot use. These versions have been referred to as the BMP-1E and BMP-2E by Western sources.

In Afghanistan many Soviet BMPs of all types have a large storage box on the rear decking. Some BMP-1s have been seen in Afghanistan with T-72M-style smoke mortars on the turret sides. It is not known whether this is a field modification or will become more widespread. A new standardised fitting for smoke mortars on the rear of the turret roof is being retrofitted to BMP-1s.

Czechoslovakia produces an ARV version of the BMP with a 1.5-tonne-capacity crane.

Mine-detecting BMPs

BMPs have been seen with an improved front-mounted mine-detecting system and a clear-lane marker fitted at the rear.

BMP-1E advances with Hip-C helicopter overhead. Both BMP and Hip have had to have extra armour added for Afghanistan combat. *(Jane's Armour and Artillery)*

Hull

The hull of the BMP, BMP-1 and BMP-2 is divided into three compartments: the engine and power-train compartment, which is mounted forward; the personnel compartment, which includes the driver and commander positions; and the turret. There is no floor escape hatch. The driver's area in the left front of the vehicle contains the controls and instruments, including a steering T-bar, clutch pedal, brake pedal, accelerator, idle adjustment screw, master switch, and warning lights and indicators. The engine fire-extinguisher system, similar to that of the T-62, can be activated automatically or from the driver's compartment. Access to the top of the engine and power train is through a hinged, armoured deck. There are two towing locks and clevis mounts at the front and rear of the vehicle. Storage boxes are provided under all seats.

Engine and suspension

The BMP's engine is an improved version of that used in the PT-76 and many other armoured vehicles. Basically half of a T-54 engine, it has a fuel-injection system, is pressure-lubricated, and has cyclone air filtration units. The BMP's single-stage air filtration system is in contrast to the highly engineered engine, being less efficient than the double-stage, very efficient filters used in most Soviet designs. The manual transmission has five forward gears and one reverse, with standard double clutch-shifting. The BMP has the same ability to produce smokescreens from its exhaust as the T-62. The same engine, with a turbocharger, is used on the BMP-2.

The BMP's suspension embodies many standard components also seen on the PT-76 and several other vehicles. It has six road wheels, with an idler at the rear and a drive wheel at the front. The first and sixth road wheels have hydraulic shock-absorbers. There are three track-support rollers. The track is wide, dead steel track. Steel grousers reduce traction on paved roads. Double-pin track-block suspension gives a smoother ride cross-country and makes less noise, although weighing more than single-pin systems. The track is similar to that used on the first T-64 tanks. The BMP was the first Soviet tracked AFV to use a steering yoke in place of the earlier clutch-and-brake system.

Weapon systems

Five Sagger ATGMs were originally carried by the BMP and BMP1, four in internal storage racks and one on the launch rail above the 73mm gun tube. The launcher cannot be employed dismounted, being permanently fixed above the tube. The initial BMP Saggers were identical to the standard command-guided missile, but the gunner required even greater than usual dexterity and co-ordination. He flew the missile by manipulating the joystick with his right hand while moving the sight and training the turret with his left hand to keep the Sagger in the sight cross-hairs at all times, a difficult feat. The SACLOS-guided Sagger that was in standard use by the late 1970s–early 1980s requires only that the target be kept in the cross-hairs. Like any ATGM-armed vehicle, the BMP must fire Sagger from the halt. Missiles can be loaded on the launcher by the gunner from inside the turret. During reloading, which takes 45–50sec, the gun must be at maximum elevation and not firing. Being under armour, the gunner is less vulnerable to suppressive fire.

The normal turret-top-mounted ATGM on the modified BMP-1 is Spigot rather than the Spandrel of Soviet BMP-2s. Unlike the Sagger-armed BMP-1, the modified BMP-1 carries a standard ground mount for its ATGM.

The 2A28 73mm smoothbore gun on the BMP is similar to the SPG-9 anti-tank weapon (the main difference being the propelling cartridge). It fires a PG-9 fin-stabilised rocket projectile much like the PG-7 fired by the RPG-7. Also like that projectile, the 73mm round is fin-stabilised and vulnerable to crosswinds, which deflect it. Particularly in a crosswind, computing deflection against moving targets with the 73mm is difficult despite the vertical lead lines on the gunner's sight. As BMP gunners have only three to six months' training before being considered fit for battle, must qualify on the ATGM and PKT machine gun as well as the 73mm gun, and carry out little full-calibre firing in training, it is unlikely that this complex aiming method is commonly or easily mastered. Moreover, the sub-calibre projectiles used in exercises often do not have the same characteristics as the full-sized round.

The mounting of such a large-calibre weapon on the BMP is possible because of the 73mm's low recoil. Because the round itself is rocket-powered, only a limited charge is needed to send it out of the gun tube and down range.

The 73mm gun's sights are graduated to 1,300m, although accuracy deteriorates rapidly above 800m and the ATGM will normally be used against armoured targets at greater ranges. Trajectory is relatively flat to 800m. The BMP-2's 30mm gun is sighted to 4,000m. The 73mm shell self-destructs at maximum range.

The BMP and BMP-1 carry 40 PG-9 HEAT and OG-9 HE 73mm rounds in two magazines which feed into an autoloader. The HE round is a more recent development, as Syrian BMPs captured in 1973 had only HEAT, and the gunner's sights were calibrated for a single type of ammunition. The autoloader permits a theoretical maximum rate of fire of six to eight rounds per minute. However, the 73mm gun automatically goes to 3.5° elevation after each round while the spent brass is ejected and the next round is loaded. This could make it difficult for the gunner to see the first round's effect on the target, thus reducing the accuracy of the second round. The 73mm gun's lack of stabilisation is a significant drawback, preventing accurate firing or even gunlaying while on the move. Attacking BMPs normally fire from the short halt, and the actual rate of fire is three rounds per minute or less.

The turret of a BMP-2, showing its Spandrel ATGM, 30mm cannon, white-light and IR searchlights, periscopes and appliqué armour.

The 73mm gun is significantly less effective than the 30mm cannon on the BMP-2. While the 73mm HEAT round has a tank-killing capability that the 30mm lacks, its low rate of fire and low individual accuracy (it is not as accurate as the PT-76's 76mm gun) offset this advantage. A 30mm cannon will be on target against a BMP before the single-shot BMP can get a shot in, and a 30mm round is as capable of knocking out a BMP or APC as a 73mm shell.

The BMP-2 and BMD-M-1981 are both armed with the 2A42 30mm gun, firing either AP-I or FRAG-HE at a rate of up to 500 rounds a minute. The effective range is 1km, maximum elevation is 74° and maximum penetration is 55mm at 500m.

All BMP versions mount the 7.62mm PKT, the standard Soviet co-axial light machine gun. Used for suppression and direct support, it is especially important to BMPs lacking HE ammunition. It cannot however fire while the 73mm gun or a Sagger is being loaded.

As on Soviet tanks, the low silhouette of the BMP has

restricted its main gun depression to 4° (in the BMP and BMP-1), limiting its ability to fight hull-down. In 73mm-armed versions,the gunner and commander each have only a 120° arc of vision, the gunner from 12 o'clock to 4 o'clock and the commander from 12 o'clock to 8 o'clock. The squad's vision blocks combine to give almost 360° visibility. BMPs, like all Soviet vehicles, will have their hatches open unless in NBC conditions or under artillery or small-arms fire.

The 73mm-armed versions of the BMP are hampered by a 55° deadspace to the left front (between 350° and 295°) in which none of the armament can be used. This is created by a bump in the turret ring which pushes the gun tube to full elevation so that it does not strike the commander's infra-red searchlight. The bump also interferes with target tracking, especially when using the ATGM. If the gunner has to track a target through the deadspace, the gun tube will elevate and block his vision, and the missile may miss. The 73mm and the PKT are unable to cover this area, and none of the squad's weapons can reach it either, despite its being the area in which the commander's view is best. The BMP-2 does away with this bump and the resultant deadspace.

Optics

Twenty 1 × power vision blocks are mounted, one for each of the nine firing ports, one in the right rear door, three in each of the driver's and commander's hatches, and four in the gunner's hatch. The commander has a TKN-3B binocular periscope sight, as on the T-62. The gunner has an IPN-22M1 sight with a stadiametric rangefinder, as used in the T-62's sights, though this is graduated only over 400–1,300m. In its day mode the sight has a 15° field of view and 6 × power. At night the passive ambient light intensification has a range of 400–1,000m depending on conditions. The night field of view is 6° with 6.7 × magnification, and there is no ranging scale; the gunner simply estimates unless artificial illumination allows him to use the day sights. The driver has a TNV-2B active-passive infra-red night vision device with a 30° field of view and a 50–60m range using the active infra-red light source, falling to 20m without it.

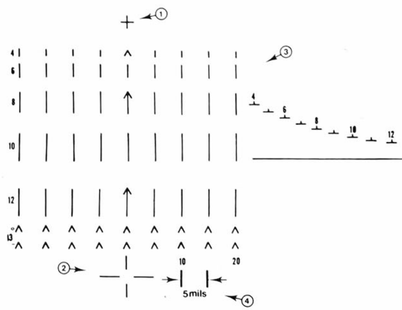
The BMP-2's optics, improved over those of the BMP-1, include the BPK-1-42 day/night sight and the IPZ-3 4 × -magnification sight. The commander has three periscopes built into his hatch cover; the gunner has a fourth, rear-looking, one as well. The BMP-2 has an additional light in front of the gunner's hatch cover on the turret top and an infra-red searchlight on the right, slaved to the 30mm gun.

The squad

The motorised rifle squad is one of the BMP's offensive weapons. They sit, very cramped, back-to-back on adjustable benches in the personnel compartment. To fire they lock their weapons into airtight firing ports. The forward two firing ports are for PKM machine guns and the other seven – three in each side and one in the left rear door – provide overlapping fields of fire for rifles. Each firing port is equipped with a periscopic 1 × -magnification vision block with a defogger. A vacuum exhaust system is supposed to remove firing gases, but it is inefficient and the compartment often fills with fumes. Small bags are attached to each firing port to collect spent cartridge cases, but these also often do not work properly, leaving the compartment awash with spent brass. The squad can also fire from their four two-man hatches above the troop compartment; this is the method used for firing weapons with backblasts, such as the RPGs and SA-7/14.

The BMP-2 has two troop compartment roof hatches but only one machine gun and two rifle firing ports per side, although the rear door firing ports have been retained and the seventh motorised rifleman, positioned where the commander sat in the BMP-1, has a machine gun port. The squad dismounts through the rear doors or roof hatches while the BMP is at the short halt or moving at up to 5km/h. It takes ten seconds for a well-trained squad to dismount or remount.

There have been repeated reports of BMP-1s and BMP-2s with a rear ramp hinged at the bottom, as on the M113, in place of the two rear doors. This would probably require fuel to be stored in the belly. The role of these BMPs is unconfirmed, although they are likely to be mortar or heavy weapons carriers.



1PN22MI day sight reticle for the BMP gunner, for use with the Sagger, 73mm gun and machine gun. Legend (not present on actual sight): (1) boresight cross (2) Sagger aiming cross (3) rangefinding reticle, graduated for 400–1,300m (4) 5-mils graduated lead lines. *(US Army)*

NBC protection

The BMP's NBC defence is based on the maintenance of overpressure using the PAZ system and a blower/dust extractor that pulls in contaminated air and extracts the fallout. In an improvement over the T-62 and BTR-60PB PAZ systems, the air also passes through a PBZ chemical/biological filter. The system does not have a warning device, although there is a radiation indicator. Firing weapons through the gunports is hazardous, as the gas exhaust decreases the overpressure. Any exit, firing the cannon, or loading an ATGM will cause contamination. Because of the shortage of internal space, it is difficult though possible to put on NBC suits inside a BMP. The filters are removed from exported BMPs.

Early-production BMPs apparently had the same filterless PAZ system as the BTR-60PB. The improved system was introduced with the BMP-1 and retrofitted to many BMPs. No BMP model provides a shirtsleeve environment, however, the Czech OT-64 being the only Warsaw Pact APC in service in the late 1970s/early 1980s to do that. But the improved system does make the protection of the NBC suits more effective and less fatiguing.

Amphibious capability

The BMP is propelled by its tracks in water at a maximum speed of 8km/h. A trim vane on the front gives stability, prevents porpoising and limits flooding over the bow. The BMP is not as good in the water as the BTR-60, and its low silhouette is dangerous in rough water. There is no evidence of provision for swim screens.

Crew functions

The BMP commander is the squad, platoon or company leader. He normally dismounts when the squad dismounts. He is the only crew member to receive formal cross-training in other tasks or who knows how to use the radio or read a map. He wears battledress and carries an AKS-74. He sits in the hull front in the BMP and BMP-1 and in the turret in the BMP-2.

The driver-mechanic is in charge of the BMP when the squad and the commander dismount. He undergoes six months of specialist training and is normally a private first-class, making him the only person holding rank aboard the BMP apart from the commander. He is responsible for maintenance under the supervision of the company technical officer and wears overalls and carries a AKSU or pistol. He sits in the hull.

The gunner, seated in the one-man (BMP or BMP-1) or two-man (BMP-2) turret, is trained for three to six months in the use and maintenance of his weapons and would probably need additional training in his unit to become proficient. When the commander dismounts, the gunner directs the driver in action even though the driver outranks him. Combat experience has shown that putting a vehicle commander in a one-man turret is a mistake, which may be one reason why the BMP-2 changed to a two-man turret. The gunner wears overalls and carries and AKSU or pistol.

BMP-1 emerging from a river, showing the extended trim vane and the improved nose design that gives it better swimming ability than earlier BMPs. (*US Army*)

The BMP-2's new crew arrangement may change the way crew functions interrelate. In the turret, the commander can use his newly acquired 360° vision to direct both gunner and driver. Individual BMP commanders will probably still dismount with their squads, but there may well be tactical situations in which Soviet battle drill will require them to stay mounted, a two-man turret normally being more effective than a one-man one. The expansion of motorised rifle companies above ten vehicles will give company commanders more opportunity to stay mounted if required.

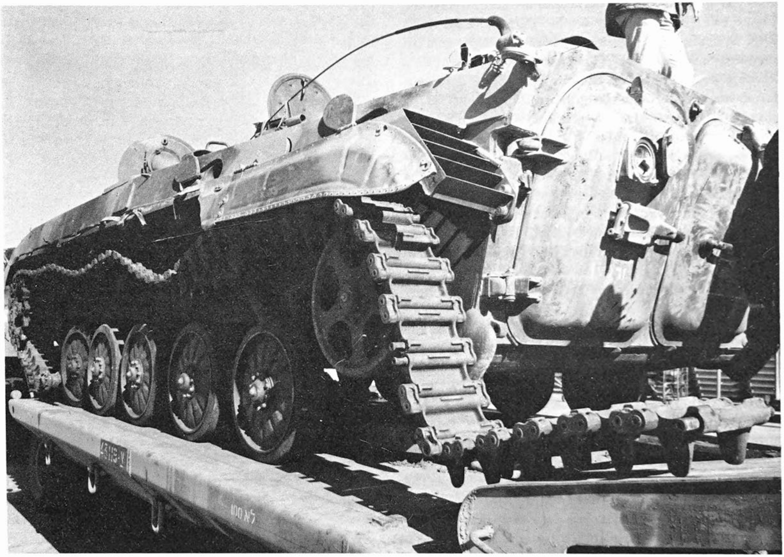
The BMP-2's turret design removes the "BMP bump," the commander's infra-red searchlight being moved to his new position on the right-hand side of the two-man turret. This also improves his view while mounted. A motorised rifleman sits in the seat in the left forward hull behind the driver which is occupied in the BMP-1 by the commander. The two-man turret reduces the BMP-2's rear troop compartment capacity to six cramped riflemen, so that only seven men dismount to fight.

Weapons effectiveness and combat usage

The effectiveness ratings of Sagger, Spigot, Spandrel and PKT on the BMP are approximately the same as those of the standard versions.

According to US Army figures, the probability of a hit by a 73mm gun fired from a stationary BMP against a stationary M60A3 in the open, first round on target, is:

Range (metres)	50	100	175	250	500	800	1,000	1,300	1,800
Probability	97%	89%	89%	83%	64%	50%	40%	28%	24%(?)



Knocked-out BMP-1 about to be airlifted from Israel to the US, showing the gunports, both the circular AKMS ports (the sighting block is visible over the closed one) and the square PK port. The bulged doors contain extra fuel. *(US Air Force)*

The relatively high accuracy for 1,800m range is striking in view of the fact that the sight is calibrated only to 1,300m. The shell used against armoured vehicles would be HEAT, capable of penetrating 400mm of armour. The US Army estimates that if a hit is scored a 73mm HEAT round has a 33% chance of killing an M60A1 and a 50% chance of killing an M113 APC.

The 30mm is likely to fire in short bursts. Individual rounds are likely to have a higher hit percentage than the 73mm gun, thanks to their high muzzle velocity and the absence of weathervaning.

The Syrian Army had about 150–170 BMP-1s in the 1973 Middle East war. Some 100 were committed to action and 50–60 were lost, many through mechanical breakdowns in the forward area. Although the Syrians were guilty of relying on stereotyped, textbook tactics and failed to use "bold and decisive manoeuvre", such as bypassing strongpoints, these battles served to reinforce the Soviet belief that speed, shock and mass are not enough in the face of modern conventional weapons. It thus required only a tactical evolution for the Soviets to see the BMP as a superb weapon for working with tanks in exploitation, consolidation, pursuit and, especially, forward detachments and *reydy*. Although these concepts antedated the BMP by many years, and the BMP is not the only weapon used for these missions, the Soviets have placed greater importance on them since the BMP entered service.

In the 1973 war BMPs were the primary equipment in the armoured brigades of Syrian mechanised divisions. The Egyptians also used the BMP, in smaller numbers. Syrian BMP units never had a chance to exploit success, suffering heavy losses in the first days that put them out of action for most of the war. The Israelis apparently have not added captured BMPs to their army, possibly because so many of those knocked out in 1973 were beyond economic repair.

Syrian BMPs of the 85th Armoured Brigade suffered heavy losses in the 1982 Lebanon War. Libyan BMP-1s have been in action in Chad. Indian BMP-1s are used in Sri Lanka. Both sides in the Iran-Iraq war have made extensive use of BMPs, although the Iranians lost many in the opening year of the war. BMPs, BMP-1s and BMP-2s have seen extensive combat in Afghanistan.

Over 150 Libyan BMPs and BMP-1s were captured or destroyed by Chadian forces in 1987 alone.

Tactical employment

All Soviet tank and motorised rifle divisions should have one BMP-equipped motorised rifle regiment, although in lower readiness categories the role is probably still performed by BTR-50s in tank divisions and BTR-60s in motorised rifle divisions. BMP-equipped units are used not only for standard motorised rifle missions but also for a large proportion of the forward detachments and *reydy*. As the BMP regiment is normally in the divisional second echelon, it performs much of the pursuit and exploitation. All motorised rifle units organic to tank regiments are BMP-equipped. BMPs are also in reconnaissance units.

Engagement sequence

Because the optics are identical, the target-acquisition and rangefinding segments of the engagement sequence of a 73mm-armed BMP is the same as in a T-62. Aiming is also similar, except that the gunner must take any crosswind into account, using the lateral lead lines. To fire the 73mm gun the gunner first pushes the trigger in the gun control handgrip. The spent brass will be ejected into a collecting basket. To reload he sets the gun controls to "ready", then depresses the "load" button on the control handgrip. A loading arm removes a shell from the ready rack. (If HE rounds are used, a selective function is required.) The arm moves upwards until the shell is aligned with the breech, the electric rammer automatically seats the round, the automatic horizontal sliding breechblock closes, and the loading arm automatically returns to the ready position. The mangling tendencies of Soviet autoloaders can make themselves evident at this point, for if the gunner is not careful or does not keep his arm protector up, his left arm is likely to be inserted into the breech instead of the shell.

Use of Sagger does not require ranging-in. The gunner removes one missile from its ready rack and, opening the loading hatch, slides it with its attached launch rail on to the receptacle on top of the gun tube. He deploys the missile's folding fins by hitting them with a stick. If he forgets to close the loading hatch, he will absorb the force of the Sagger's launch blast. Loading time is about 50sec. To fire he pulls the control box up from beneath his seat and depresses the activating pedal; the Sagger can then be fired. Cross-hairs at the bottom of the sight are used for guidance; Sagger has no night sight. Spandrel or Spigot launch tubes have to be externally attached to their firing mount on the turret roof. Spandrel is probably fired and controlled from under armour in the same way as Sagger, but the Spigot launcher on the BMP-1 requires the gunner to fire from an open hatch.

Vulnerabilities and countermeasures

The BMP's armour is not much heavier than that of most APCs. The vehicle is an offensive weapon, and the Soviets appear to have been unwilling to armour it to an extent that would reduce mobility or make it even more expensive. The BMP's front armour – but not that on its flanks – will stop 12.7mm ball. Considering the heavy losses that Syrian T-62s suffered at the hands of Israeli armour, the fact that equally severe losses of BMPs were considered extraordinary is mysterious. Perhaps the Syrians fell into a common trap when using BMPs: if a vehicle looks like a tank, it tends to be used as such, even though it is not one.

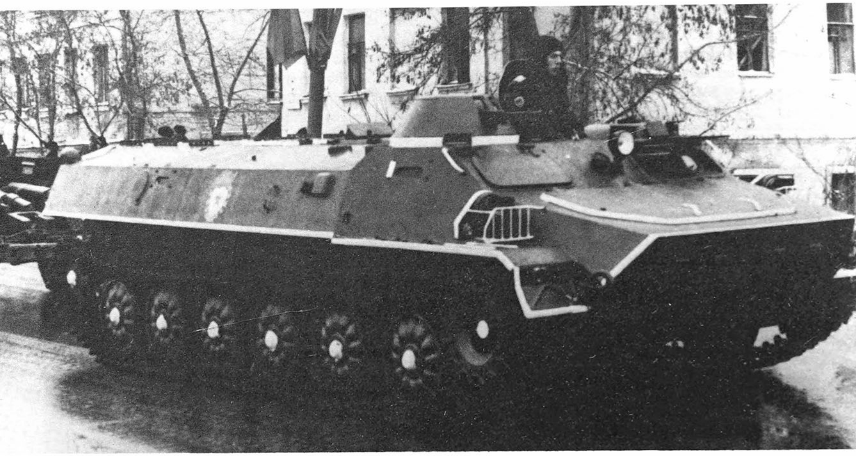
Except for the ribbed engine cover plate of magnesium-aluminium alloy, the BMP is constructed of high-quality steel in ballistic areas, with lower-quality steel elsewhere. In the Middle East, brew-ups and secondary explosions were frequent, a result of the dense packing of vulnerable systems and materials, and the incorporation of fuel tanks in the rear door. A penetrating shell will almost certainly hit something vital.

The Afghan Resistance has found that BMPs hit by RPG-7s or 82mm recoilless anti-tank gun rounds tend to explode or quickly brew up. Even if they do not penetrate the hull or turret, 12.7mm rounds cause severe spalling inside the crew and troop compartments, requiring the use of body armour.

MT-LB armoured personnel carrier

Length 6.354m **Width** 2.85m **Height** 1.865m **Track** 2.5m **Ground clearance** 0.4m **Weight** (empty) 9,700kg, (combat load) 11,900kg **Ground pressure** 0.4kg/cm² **Payload** 2,000kg **Towed load** 6,500kg **Seats** (front/rear) 2/11 **Max speed** (without trailer) 61km/h, (with trailer) 46.8km/h **Water speed** 5–6km/h **Road range** 500km **Fuel** 520litres **Slope** (without load) 35°, (with load) 25° **Tilt** 25° **Armour** (glacis) 14mm equivalent, (elsewhere) 7mm equivalent **Armament** 7.62mm PKT **Ammunition carried** 2,500 rounds **Elevation** –5°/+30° **Turret rotation** 360°

The MT-LB armoured multi-purpose tracked vehicle can be used as a personnel carrier, weapons tractor or cargo



MT-LB towing a 100mm T-12 in a November 1977 parade in Moscow. The gunport on each side of the passenger compartment is evident, as are the vision blocks. A total of 3,300 MT-LBs were in service in 1986. *(US Army)*

carrier. It introduced a new engine and other components that have since appeared in a whole family of armoured fighting vehicles. It is the nearest Soviet equivalent to the US M113, being a relatively cheap but reliable armoured vehicle that can be used not only in the APC (but not infantry fighting vehicle) role but also as a platform for a wide variety of systems. In 1983 the various BTR-series vehicles outnumbered the MT-LB series in the Soviet inventory by a ratio of about nine to one.

Apparently intended as replacements for older types of tractor, the MT-L tractor and MT-LB are designed to perform a range of tasks in a wide variety of climatic and terrain conditions. The MT-LB is usually used as a gun tractor. The MT-L, the unarmoured cargo-carrying version, is used in civilian projects in the far north and Siberia. Like most civilian load-carrying vehicles in the Soviet Union, these MT-Ls are available to the Army under the *autokolomka* system. The MT-L seems to have been produced only in limited numbers and did not replace the GT-T tractor. The MT-LB is used as an armoured personnel carrier by a number of Soviet Army units.

First observed in 1970, the MT-LB is probably a development of the MT-L. It retains the engine and basic layout of the MT-L, but with a completely different body, a low silhouette and a turret-mounted machine gun. Standard Soviet light armoured fighting vehicle construction methods, based on high-quality steel, are used.

The hulls are self-supporting, without a chassis, and built up from three basic assemblies: cab, frame and cargo bed. Both have three hull compartments: crew forward, engine amidships and cargo at the rear. A passage to the right of the engine compartment links the crew and cargo compartments.

The MT-LB's cargo compartment is under armour and fitted with folding canvas seats for 11 men facing inwards. It is reached through two roof hatches and two rear doors which, unlike similar doors on the BMP, do not contain fuel. Gunports similar to those of the BTR-60PB are provided in each rear door and on each side of the cargo compartment. Many MT-LBs carry a large armoured cargo pannier on their rear decking. This is often used for artillery ammunition. From a distance, MT-LBs with this pannier could be confused with SA-13 SAM vehicles.

The driver sits on the left and the commander on the right of the crew compartment. The commander also mans the turret, which is armed with a PKT 7.62mm light machine gun. The turret itself appears to be a scaled-down version of that fitted to the BTR-70.

The YaMZ-238V engine is an improved version of the YaMZ-238 truck powerplant, a high-compression four-stroke V-8 diesel generating 240hp at 2,100rpm. A pre-heating unit warms the water in the engine to 70°C before start-up. Engine and transmission oil is also pre-heated, allowing operations at temperatures as low as −45°C.

The engine powers the forward drive wheels through a

universal driveshaft and synchronised transmission with one reverse and six forward gears. Gears two to six can be reconverted, which effectively gives eleven forward gears. This helps the engine to function at low revolutions while maintaining a practical speed, important for towing in soft ground. Suspension comprises two torsion bars and hydraulic shock-absorbers on swing arms on the first and last of the six rubber-rimmed road wheels on each side. While the road wheels resemble those of the PT-76, they are actually a new design. An idler is fitted at the rear and the tracks rest directly on top of the road wheels, as in Christie-type suspensions.

The standard tracks are 350mm wide and of the open-link two-pin type, made of non-magnetic Hadfield steel which work-hardens in use. Track life is 2,800–3,000km, pin life 1,800–2,000km. The MT-LB can also be fitted with extra-wide (565mm) tracks and an "aggressive" grouser to facilitate over-snow and soft-ground operations. Vehicles fitted with these tracks are designated MT-LBV, ground pressure being reduced to 0.28kg/cm^2.

The MT-LB is amphibious, propelled by its tracks. Areas round the rear door must be caulked if extensive swimming is anticipated. A trim vane is extended from the lower hull front before entering the water, and the vehicle must be ballasted first if not loaded.

The MT-LB mounts a small OU-3GK white-light/infra-red searchlight with a range of approximately 400m for the commander and the standard Soviet TVN-2 infra-red vision device, with a range of 40m for the driver. 1 ×-magnification TPN-165 vision blocks, replaceable from the inside, are mounted in the hull sides. Both the driver and commander have large glass forward-looking vision blocks which are covered in action by armoured screens, an arrangement similar to that of the BTR-60PB. Most MT-LBs apparently carry the standard Soviet R-123 AFV radio and intercom. The MT-LB is fitted with a PAZ NBC defence system and a PBZ chemical filter system.

MT-LB of the Hungarian Army with a steel pannier on the rear hull decking; this is frequently used to carry artillery ammunition. MT-LBs so equipped can be mistaken for SA-13 launchers.

Weapons effectiveness and combat usage

The MT-LB's only on-vehicle weapon is the light though reliable PKT. The commander acts as gunner in the one-man turret, which is a disadvantage.

MT-LBs have been extensively used in Afghanistan since at least 1984. They are normally used to tow artillery, especially D-30s, and to carry ammunition; roof panniers are frequently fitted. They are also used to carry supplies to Soviet and DRA outposts on routes affected by sniping. There have been no reports of them being used in the APC role. Variants – including the SA-13 and Big Fred radar vehicles – have also been used there.

The MT-LB is considered reliable by comparison with earlier Soviet tracked vehicles such as the BMP.

Tactical employment

The MT-LB is primarily an artillery tractor. A number of Soviet divisions, especially tank divisions, use it as their standard gun tractor, replacing earlier full-track designs. MT-LBs are used in place of GAZ-66 trucks to tow M1943 120mm mortars in some BMP-equipped motorised rifle battalions.

The MT-LB has some shortcomings in this role: the spraying action of its tracks means that the gun is coated with mud or dust much more readily than it would be if towed by a wheeled vehicle, and it has a tendency to break away from the gun when going downhill on icy or muddy slopes. The MT-LB must not speed when towing a gun, particularly if the ground is rough: it is easy for the muzzle of weapons such as the 100mm anti-tank gun to hit the ground.

The MT-LB is also extensively used as an armoured personnel carrier. Its lack of vehicle-killing armament is to an extent balanced by its cheapness, low silhouette and cross-country mobility. Soviet motorised rifle units equipped with MT-LBs will probably operate in areas where enemy armour is likely to be rare. The 45th Motorised Rifle Division at Murmansk and the 34th Motorised Rifle Division at Kandalaksha, both located in the northern area of the Leningrad Military District and deployed for operations in northern Scandinavia, are among the units using the MT-LB as their standard APC. Reports in 1986–87 stated that MT-LBs were replacing at least some of the BTR-60PBs used as standard APCs by the 63rd Guards Naval Infantry Brigade, based at Pechenga.

In the APC role the MT-LB is used in much the same way as the BTR-60PB, in direct support of dismounted troops.

Another unit which makes extensive use of MT-LBs in the APC role is the 32nd Guards Motorised Rifle Regiment of the US Army. Stationed at the National Training Centre, Fort Irwin, California, this unit uses over 20 MT-LBs in its mission of simulating Soviet forces in training exercises.

The MT-LB is often used as a cargo carrier in the artillery support role, hauling ammunition and fire-control equipment. MT-LBs replace ammunition trucks in some towed and SP artillery battalions and have seen combat in this role in Afghanistan. Its NBC protection, rear entry doors and large cargo area make the MT-LB an excellent armoured ambulance, and a version has been produced for this purpose.

MT-LBs have been seen operating in company with an ACRV-2 (artillery command and reconnaissance vehicle) and a radar-equipped PRP-3 vehicle. It is believed that, together, these three vehicles would make up the command observation post of a large Soviet artillery unit, the ACRV-2 carrying the headquarters, the PRP-3 the radar and the MT-LB the fire-control computers.

Variants

The MT-LBU is the command APC version, carrying extra radios, a generator, a land navigation system and a canvas covering extended from the rear of the vehicle when it is stationary. Other variants mount SA-13 SAMs and a variety of radars, including the large Big Fred (vehicle weight 11.5 tonnes, height with antenna down 2.9m, 4–6 crew, 20km radar range).

The MTP-LB mobile repair vehicle is an MT-LB with a 1.5-tonne capacity jib crane for engine lifting and recovery.

The MT-LB engineer vehicle has a rear-mounted plough blade and a rectangular box on the rear deck for carrying equipment. It retains the machine gun.

The engine, suspension and other components of the MT-L and MT-LB have been used in a number of Soviet AFVs, most notably the 2S1 (M-1974) 122mm self-propelled howitzer and the ACRV-2.

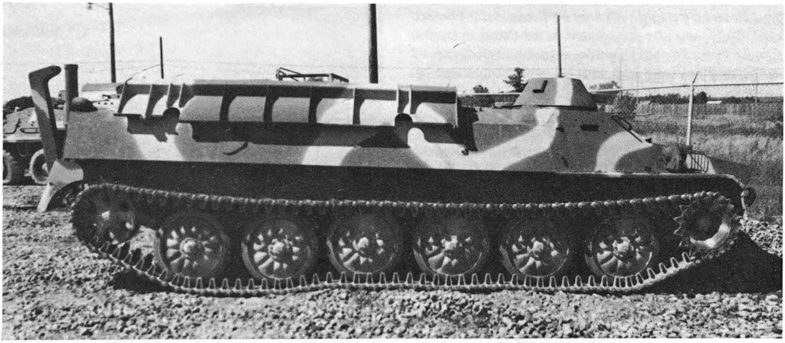
Foreign usage

The BTR-152 has been supplied to Afghanistan, Albania, Angola, China (where it was built as the Type 56 APC), Congo, Cuba, Cyprus (where it saw some action against the Turks in 1974), East Germany, Egypt, Ethiopia, Guinea, Guinea-Bissau, Hungary, India, Indonesia, Iran, Iraq, Israel, Kampuchea, Mali, Mongolia, North Korea, North and South Yemen, Poland, Romania, Somalia, Sri Lanka, Sudan, Syria, Tanzania, Uganda, Yugoslavia, Zaïre and Zimbabwe. The anti-aircraft versions have been used by Warsaw Pact armies, Ethiopia, North Korea and other nations.

The BTR-50 series has been supplied to Albania, Algeria, Angola, Bulgaria, China, Congo, Czechoslovakia

A Model 2 ACRV-2, without the 7.62mm machine gun. The turret contains a laser rangefinder and associated artillery fire-control equipment. *(AFV G-2)*

Left: MTP-LB mobile repair and engineer vehicle demonstrates its jib crane.



Below: Engineer MT-LB with blade attached to the upper deck in travelling position. *(Steven J. Zaloga)*

(before OT-62 production), East Germany, Egypt, Finland, Guinea-Bissau, Hungary, India, Iran, Israel, Libya, Nicaragua (20), North Korea, Poland, Romania, Somalia, Sudan, Syria, Vietnam (used at An Loc in 1972) and Yugoslavia. Many of these vehicles are Czech-built OT-62s, and several armies use both Czech and Soviet-built machines. Most of those still in service with the Warsaw Pact are probably Czech-built.

The BTR-60 series has been supplied to Afghanistan, Algeria (200), Angola, Botswana, the Warsaw Pact armies (except for Czechoslovakia), Cuba, Djibouti (10), Egypt, Ethiopia, Finland (120), Guinea-Bissau, Iran, Iraq, Israel, Libya, Mali, Mongolia, Nicaragua (50), North Korea, North Yemen, Somalia, Syria, Uganda, Vietnam and Yugoslavia.

BMPs and BMP-1s have been supplied to Poland, East Germany, Czechoslovakia and Hungary in the Warsaw Pact. Afghanistan, Algeria, Cuba, Egypt, Indian, Iran, Iraq, Libya, Mongolia, Mozambique, North Korea, South Yemen, Syria and Yugoslavia have received exported BMPs. BMP-2s are used by East Germany, Poland and Czechoslovakia.

The US Army has had the opportunity to examine all Soviet APCs and has several OT-62s, BTR-60PBs and BMPs.

MT-LBs and ACRV-2s have been exported to most of the Warsaw Pact nations. MT-LBs are also used by Yugoslavia, Finland and the USA.

Chapter Ten

Anti-tank weapons

"A system of anti-tank defence is built on the basis of all anti-tank weapons and their co-ordination with nuclear attacks and with each other, and must envisage their grouping and manoeuvre with due regard for enemy action and maximum utilisation of the protective features of the terrain."

G. BIRUKOV and G. MELINKOV

The importance of anti-tank warfare permeates the Soviet Army. Every weapon plays a part in the defeat of enemy armour. Every unit has an anti-tank capability, a legacy of 1941, when Soviet anti-tank weapons, few and inadequate, proved a weak barrier to the *panzers*. But the Soviets learned fast, and at Kursk in 1943 a combined-arms anti-tank defence in depth halted the *blitzkrieg* forever. The success of Kursk still guides Soviet anti-tank weapons and tactics.

Anti-tank weapons form a mutually supporting system at each level of organisation, allowing the Soviets to optimise and integrate their employment. The slow-firing but accurate anti-tank guided missiles (ATGMs) provide long-range fire, starting at a range of 3–4,000m. At 1,500m, when volume of fire is more important than individual accuracy, tanks and towed anti-tank guns will open fire. BMP 73mm guns open fire at 800m, being better than the ATGMs at close range. Close defence is provided by the many widely deployed RPG-7s, RPG-16s and RPG-18s. In addition, all field and anti-aircraft artillery has an anti-tank role.

True to its offensive, armoured outlook, the Soviet Army believes that the best anti-tank weapon is another tank. But the Soviets have never let their emphasis on tanks blind them to the importance of other anti-tank weapons. They are fully aware that the wide range of modern anti-tank weapons threatens the very basis of their armoured offensive, and much of their tactical evolution in recent years has been aimed at overcoming this threat.

The Soviets field a full range of ATGMs, ranging from the first-generation AT-1 (now obsolete), AT-2 and AT-3, through the second-generation AT-4, AT-5 and AT-6. However, they still use towed anti-tank guns, the 100mm T-12 in motorised rifle divisions and the 85mm SD-44 in airborne units. The 82mm and 107mm recoilless anti-tank guns have been replaced by man-portable AT-3 and AT-4 ATGMs and the 73mm tripod-mounted SPG-9 gun, which fires the same rocket projectile as the BMD and BMP. Masses of the RPG-7 and RPG-16 rocket grenade launchers provide close-range defence, as do the RPG-18s of individual soldiers, replacing the shaped-charge grenades, issued as ammunition, that were previously the light anti-tank weapons. The Soviet anti-tank defence system is a formidable one.

RPG-16 captured by the Afghan Resistance in 1986. Note the "iron" sights. *(Jamiat-e-Islami Afghanistan)*

Anti-tank weapons on the defence

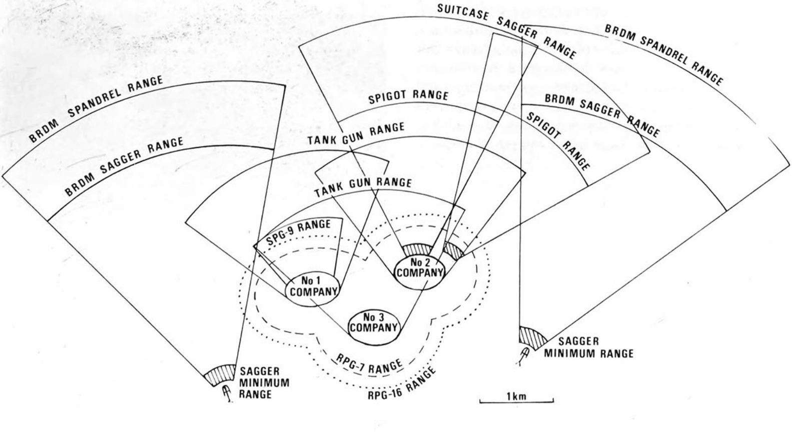
While organic, specialised anti-tank weapons and units are unnecessary in tank units, every Soviet motorised rifle and airborne battalion, regiment and division has its own anti-tank unit. Every Soviet commander from sergeant to major-general can deploy his own anti-tank assets. The different levels of anti-tank defence create a defence in depth, a defence that is interlocking in unit size, weapons capability and deployment.

Battalion positions will rarely be without the support of overlapping fields of fire from battalions on their flanks and behind them, and from regimental and divisional anti-tank weapons. The Soviets can mass 25 to 35 tank-killing weapons per kilometre of front, not counting RPG-18s. The defence will be aligned so that the heaviest weapon concentrations will cover the most likely avenues of approach. The defensive strongpoints themselves will if possible be on terrain unfavourable to armour, in order to prevent overruns. Whenever possible all Soviet units will plant extensive anti-tank minefields, and engineer equipment will be used to create obstacles and barriers (especially in defiles or wooded tracks) and to dig anti-tank ditches. Minefields and obstacles will channel the enemy into "fire pockets", pre-planned concentrations of anti-tank fire that will hit the targets from all sides and with many weapons. Soviet units will hold their ground even if the enemy breaks through, and their all-round defence will join the second line of defence in creating a fire pocket. Indirect-fire artillery will be the first weapons to engage attacking enemy tanks, and will maintain the fire on them through the depths of the defence, forcing them to "button up" and thereby reducing their visibility, or blinding them with smokeshell. The Soviets believe that indirect artillery fire can disorganise an attack before the anti-tank weapons open fire. The emergence of conventional submunition rounds (including some HEAT) for Soviet tube artillery, rockets and surface-to-surface missiles also gives indirect-fire artillery an increased tank-killing capability, especially against assembly areas. If necessary, the artillery and anti-aircraft guns will engage tanks with direct fire.

All defending Soviet divisions and regiments, and often battalions, have an anti-tank reserve. This can include tanks, engineers and field artillery, but is usually built around the divisional anti-tank battalion or regimental anti-tank company. Positioned behind the first echelon, they can move to stop any enemy breakthrough, aid counterattacks or beleaguered first-echelon units, or disrupt any attacks on the second echelon. The Soviets attach great importance to this anti-tank reserve, both defensively and as part of the counterattack. Operational-

Comparison of the ranges of first-generation (Sagger/RPG-7) and second-generation (Spigot and Spandrel/RPG-16) heavy and medium anti-tank weapons in a battalion defence. In the mid-1980s a high-readiness BTR-equipped battalion had three Spigot manpacks and six SPG-9s. The replacement of anti-tank grenades with RPG-18s resulted in a longer light anti-tank reach. Tank weapon range is greatly extended if the supporting tank company includes Songster-armed T-64Bs or T-80s.

INTERLOCKING FIELDS OF FIRE (BTR-EQUIPPED BATTALION)



level formations will have both anti-tank and tactical reserves. The former can include army-level helicopter regiments, independent tank regiments and brigades, and tank regiments drawn from second-echelon divisions. Anti-tank reserves are also used in the attack, moving forward with exploiting forces against enemy counter-attacks on the flanks of a penetration.

The anti-tank reserve also provides overlapping fields of fire with both first and second-echelon anti-tank weapons. This is especially important in modern warfare. When NBC or conventional fires neutralise a particular sector, the adjacent units will have to cover the gap until the reserves can come up.

Engineers are an important part of Soviet anti-tank defences, laying mines, creating barriers and abatis, digging anti-tank ditches and preparing emplacements for anti-tank weapons.

Anti-tank ambushes are positioned along expected enemy advance or withdrawal routes in conjunction with the rest of the overlapping anti-tank defences. Ambushes are often used by outposts and rearguards, or where there are insufficient anti-tank weapons available to cover the front, after powerful enemy preparatory fire, for example. Ambushes will be set in woods, where the targets cannot manoeuvre and the Soviets can displace under cover to a new position to repeat the process. They are also used offensively to defeat enemy armour, especially when no Soviet tanks are available. The Soviets will try to work up to enemy mechanised units in night positions with tank-killer teams, as similarly armed North Vietnamese and Afghan guerrillas have done.

All Soviet anti-tank weapons and tactics have an offensive function. In the meeting engagement they guard against surprise and enemy flank attacks, while also providing a base of fire against enemy armour when the Soviets go into the hasty attack. Anti-tank weapons are distributed throughout the line of march, so that if any unit is forced to assume the hasty defence until the next unit comes up, its crucial anti-tank elements will be at hand and can then join in the Soviet attack. If required, the Soviets will push anti-tank weapons forward even in a mobile, open battle. All of them have a very important offensive role.

In the breakthrough attack anti-tank weapons will join in the preparation. They will also follow immediately behind assaulting troops to consolidate their gains or, if they are halted, reinforce the hasty defence. If they are established in a captured enemy position they can serve as a base of fire to support the second echelon as it moves in to continue the attack.

Anti-tank weapons in Afghanistan

In Afghanistan the Soviets have little need for anti-tank weapons in their primary role. The Afghan Resistance has limited numbers of armoured fighting vehicles and has rarely used them in action, although three T-54/55s were to have been used to create gaps in minefields for the final assault on the fort at Urgun in Paktia in December 1983. DRA Army troops armed with RPG-7s deterred the Resistance tankmen, however, and the position was held.

This was an isolated incident, and the main use of Communist anti-tank weapons in Afghanistan has been as a supplement for dismounted firepower. The RPG-7, RPG-16 and RPG-18 have been extensively used in this role, upgunning Soviet motorised rifle and airborne subunits. The DRA forces have only limited numbers of RPG-7s and no RPG-16s and 18s. Sagger ATGMs have also been used in this role. While large anti-tank guns have been seen in Afghanistan, there have been no reports of them being used in the field artillery role.

The Soviet use of anti-tank weapons in Afghanistan represents a case of tactical adaptation similar to that of US forces in South-east Asia which used anti-tank weapons, often quite effectively, in counter-insurgency battles.

The Afghan Resistance makes extensive use of Soviet-designed anti-tank weapons. The RPG-7 and the TM-46 anti-tank mine have claimed a large toll of Soviet vehicles. One RPG-7 gunner, Hamid Walid of Wardak province, destroyed 22 vehicles before his death in action in July 1983. 82mm recoilless rifles are also much used, especially in attacks on Communist positions.

Right: Mohammed Shuaib, combat photographer for the Resistance party *Jamiat-e-Islami Afghanistan*, holds an RPG-18. This example received its explosive fill in 1978. *(Jamiat-e-Islami Afghanistan)*

The future

The widespread use of a generation of Western battle tanks with compound armour calls into question almost the entire range of Soviet anti-tank weapons. The new armour will reduce the HEAT warheads on which most of these weapons rely from efficient to rather indifferent tank-killers. Live Sagger rounds have been fired at the Chobham-armoured US M-1 tank. Their only effect was reportedly to damage the paint.

One possible course is shown by the AT-6, with a HEAT warhead that may be large enough to defeat even Chobham armour, especially if it strikes the tank's weaker roof armour. Alternatively, ATGMs may simply become more massive, perhaps based on SAMs such as the SA-8. Another counter to the new armour would be to emphasise kinetic-energy weapons rather than ATGMs with their HEAT warheads.

New systems may influence the way Soviet anti-tank weapons are used in the future. The AT-8 Songster gives tank units a long-range capability. The AT-7 may be either a replacement for the AT-3 and AT-4 manpacks, or a new company-level weapon, the anti-vehicle equivalent of the anti-personnel AGS-17. The RPG-16 and RPG-18 are both of marginal effectiveness against modern main battle tanks. When it comes to replacing them, the Soviets cannot help but share the dilemma faced by Western armies: any weapons powerful enough to penetrate a modern main battle tank frontally may be too heavy to be carried by a single man.

Unit organisation

Divisional anti-tank battalion (motorised rifle and artillery divisions)
Total strength: 23 officers, 259 enlisted men, 18 100mm T-12 AT guns, 6 BRDM scout cars, 18 MT-LB gun tractors or trucks, 22 trucks (some may be replaced by MT-LB).
One HQ battery (6 officers, 25 enlisted men, 9 trucks, 2 BRDMs or BTR-60PUs)
Three AT gun batteries (each 5 officers and 60 men, organised as a standard artillery battery, guns often towed by MT-LBs)
One service battery (2 officers, 54 men, 11 trucks, 1 BRDM)
Since the early 1970s one gun battery has been replaced in many divisions by an ATGM battery with nine ATGM-armed BRDMs, four BRDM scout cars, three ZIL-131 trucks and one ZIL ATGM simulator van. The battalion now also has three battlefield surveillance radars and three laser rangefinders, one of each per battery. Motorised rifle divisions in Group of Soviet Forces Germany have anti-tank battalions with 12 T-12As and 12 Spandrel-armed BRDMs each. Some lower-readiness divisions may have D-48 85mm guns in place of T-12As.

Regimental anti-tank guided missile battery (motorised rifle regiments)
Total strength: 4 officers, 53 enlisted men, two/three trucks, nine BRDMs armed with ATGMs, one BRDM-2U command vehicle, three BRDM scout cars (one for each platoon), one ZIL van with ATGM simulator, one laser rangefinder. Officers are battery commander and three platoon commanders. Each BRDM also carries an RPG-7/16 and a light machine gun, used to cover dismounted scouting and to guard against close assault.

Battalion anti-tank platoon (motorised rifle battalion)
Total strength: one officer, 13–17 enlisted men, two Sagger or Spigot manpacks, two SPG-9s, three RPG-7s, 13–18 AKMSs. Normally mounted in two APCs, this platoon almost certainly is not organic to BMP-equipped battalions. It has been reported that in high-readiness BTR-equipped battalions this platoon has been strengthened to: 30 officers and men, 5 BTRs, 6 Spigot manpacks, 3 SPG-9s, 4 RPG-7/16s, 8 AK-74s.

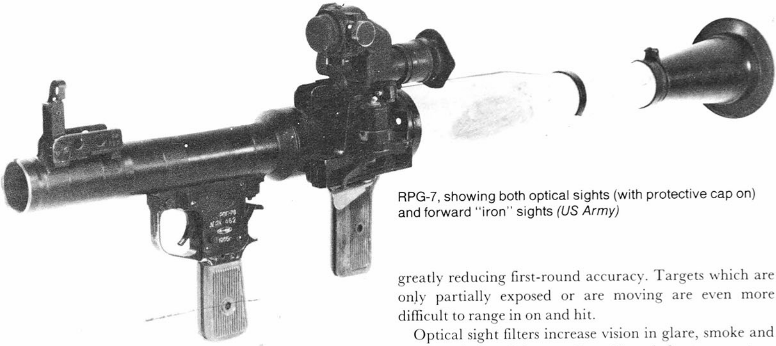
RPG-7

Tube calibre 40mm **Round calibre** 85mm **Tube length** 95.3cm **Round length** 90.5cm **Tube weight** 7.9kg **Round weight** 2.5kg **Muzzle velocity** 120m/s **Max velocity** 300m/s **Effective range** 300–500m **Min range** 5m **Armour penetration** 330mm **Rate of fire** 4–6rpm

The RPG-7 (*Reaktivniy Protivotankoviy Granatomet*, rocket anti-tank grenade launcher) is the most widespread Soviet anti-tank launcher. Every motorised rifle and airborne squad has an RPG-7 or 16, which is seen as its single most important weapon. At night or in dense terrain, where other weapons cannot be used at long range, or cannot be used at all, the RPG-7 has increased value. Combat experience throughout the world has shown the effectiveness of the RPG-7.

The RPG-7 is currently issued in two models, the basic RPG-7V and the airborne RPG-7D, which can be broken down into two parts. A development of the earlier RPG-2 (itself developed from the Panzerfaust 150), now replaced in Soviet service, the RPG-7 launches a PG-7 rocket-propelled anti-tank projectile with a HEAT warhead and "fin and spin" stabilisation, or a 7.62mm sub-calibre training round. Reports have also mentioned the development of an improved, two-stage grenade for the RPG-7, extending its effective range by 200 additional metres.

In the 1970s the Soviets increased the capability of the RPG-7 by introducing two new types of ammunition, the



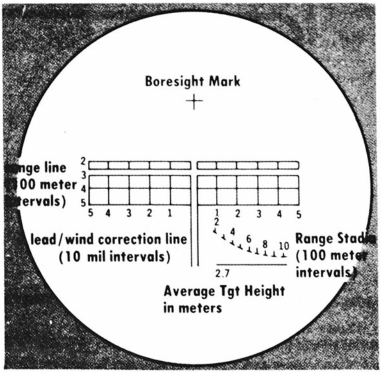
RPG-7, showing both optical sights (with protective cap on) and forward "iron" sights *(US Army)*

HE OG-7 and HEAT PG-7M. OG-7 was introduced in the late 1970s and has seen action in Angola and Afghanistan. It uses the same O-4M fuze as the 82mm mortar round. OG-7 is smaller than PG-7 and is reported to have a higher velocity. It makes the RPG-7 an effective source of dismounted HE firepower at medium range, something the Soviets have certainly needed in Afghanistan. PG-7M has a cone diameter of 70mm, which, along with the absence of the PG-7's fluted nose cover, makes its nose appear long and thin. It has the same internal HEAT warhead as the SPG-9 round, and an improved motor. Performance, especially armour penetration, is better than that of the PG-7. This new ammunition will probably allow the RPG-7 to remain in service in place of the RPG-16 in lower-readiness formations and with Soviet export customers until at least the end of the 1980s.

The RPG-7 has two sights: the basic 2½ × optical sights with rangefinding stadia, and secondary tangent sights. The optical sights are the most complicated part of the RPG-7, too complicated for many trainees, according to Soviet publications. The gunner must take many variables into account and make many estimates to sight an RPG-7. The Soviet RPG-7 manual devotes more space to sighting problems than to any other topic. Aiming the RPG-7 is difficult because the PG-7 projectile is seriously affected by crosswinds in flight. The reaction effect of its rocket motor turns it into the wind, so that the RPG-7 gunner must estimate the direction and speed of the wind as well as that of the target. The sight picture is gridded off in parallel vertical lines to determine deflection for wind and target motion, while its rangefinder stadia measures the full target height to estimate range. Maximum sight range is 500m; there are horizontal gridded lines on the sight to give proper elevation up to that range, but not beyond. US tests of captured RPG-7s revealed that even well trained gunners are normally 10–15% off in estimating the range, greatly reducing first-round accuracy. Targets which are only partially exposed or are moving are even more difficult to range in on and hit.

Optical sight filters increase vision in glare, smoke and haze, and the sight can be adjusted for temperature extremes. It is internally lit for night use, or it can be replaced with a night sight, either the 6kg, 1956-vintage NSP-2 active infra-red sight or the PGN-1 passive-starlight scope, which amplifies existing light; this 3.5kg unit was introduced in 1969. The PGN-1 was used by the Arabs in the 1973 War. The NSP-2 was used in Vietnam and can detect targets 150–200m away, while the PGN-1 can do so at twice that range.

When speed of fire is more important than accuracy, the gunner may use the iron tangent sights, which, although they have no wind or deflection adjustment, can be used at 200–500m range. Many foreign users of the RPG-7 rely on the iron sight because the intricacies of the optical sight are beyond them.



Optical sight picture of an RPG-7 (English-language legends do not appear on the original). *(US Army)*.

Combat usage

Introduced in 1962, the RPG-7 first saw action in the 1967 Middle East war. Each Egyptian infantry platoon had only one RPG-7, which made them extremely vulnerable to armoured attacks, but they still destroyed many Israeli tanks at Rafah and El Arish. Impressed by the RPG-7, the Israelis adopted the captured weapons.

Used in Vietnam in 1967, the RPG-7 was more effective than the widely used RPG-2 (known as the "B40" by the North Vietnamese) and Chinese-built 57mm and 75mm recoilless rifles. As well as serving as an anti-tank weapon, the RPG-7 was used against bunkers and emplacements and in urban combat. Two US Marine battalion commanders stated that the RPG-7 was the most dangerous single weapon in the fierce house-to-house fighting in Hue in 1968.

The Egyptian infantry that crossed the Suez Canal in 1973 were lavishly equipped with RPG-7s, often taken from the units remaining in Egypt (which made those units vulnerable when the Israelis took the offensive). RPG-7s were used in conjunction with Sagger ATGMs to defeat Israeli tank attacks in the first days of the war, and the Syrians also used RPG-7s offensively during the same period. The Israeli tanks that were destroying the Syrian armour at long range were unsupported by infantry, enabling Syrian RPG-7 teams to work their way up close to the Israeli tanks and knock out many of them. On the Syrian front RPG-7s destroyed more Israeli tanks than any other type of weapon.

In addition to the Middle East and Vietnam, RPG-7s have been used in Northern Ireland and in almost every armed conflict in the world since 1967.

The RPG-7 remains popular among terrorists worldwide. Best known terrorist use is the attack on General Kroesen, Commander of US Army Forces in Europe, in September 1981. It has also been employed by the IRA, chiefly against police stations in Ulster.

The RPG-7 is the major anti-tank weapon of the Afghan Resistance, which has used it against a wide variety of targets. The initial supply came largely from the stocks of the Afghan Army, which lost most of its RPG strength in battle or through desertion; the balance was reclaimed by the Soviets in 1981. Resistance stocks have been supplemented by examples captured from the Soviets. Numbers of weapons and ammunition remain limited in spite of an increase in the supply of Soviet, Chinese and other versions starting in 1983–84. Though Afghan RPG gunners are often poorly trained, the weapon is responsible for the destruction of a sizeable proportion of the 2–3,000 vehicles claimed by the Resistance up to 1985.

RPGs have been extensively used by both sides in the Iran-Iraq War. Iranian tank-killer teams armed with RPGs have been one of the principal causes of Iraqi losses.

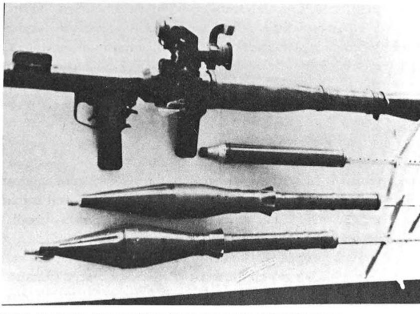
RPGs have also played a central part in the Lebanon fighting. They are used by all sides, including Israel, and against a wide variety of targets.

Hit probability

Type of target	Range (metres)					
	50	100	200	300	400	500
1st round, exposed, stationary	98%	91%	52%	27%	10%	5%
1st round, hull-down	80%	70%	20%	9%	3%	–
2nd round, exposed, stationary	98%	95%	78%	56%	38%	25%
2nd round, exposed, moving	97%	90%	55%	27%	16%	6%
2nd round, hull-down	80%	68%	35%	18%	10%	–

The target is an M60A3 tank moving at 16km/h at an angle of 30° from the RPG-7, wind at 11km/h. It is apparent that owing to the difficulty in estimating deflection, wind effect and range to hull-down tanks, the RPG-7 gunner must assume a first-round miss at all but the closest ranges and apply corrections to the second round, which takes 14sec to get ready. The RPG-7 requires massed fire for maximum effectiveness.

A PG-7 projectile can punch a 5cm hole through the equivalent of 280mm of armour, pushing hot metal fragments and the jet streaming from the shaped charge into the target, followed by the copper slug produced from the projectile liner, which will ricochet inside a tank and often go through APCs. Armour penetration varies with range and individual grenades. Some have penetrated



RPG-7 with its ammunition (from the top): OG-7 HE-Frag round, improved PG-7M HEAT round, standard PG-7 HEAT round. *(Jane's Infantry Weapons)*

Range (m)	50	100	150	200	250	300	350	400	450	500
Penetration (mm)	265	220	225	240	265	280	280	280	285	290

over 300mm of armour. At under 300m range, however, the PG-7's speed reduces the penetration of its shaped charge.

If a PG-7 hits an M60A1 it has a 40% chance of knocking it out, but only a 5% chance of completely destroying it.

Although it does not have an anti-personnel round, the RPG-7 is effective against buildings and fortifications. It can penetrate 23cm of sandbags, 45.7cm of reinforced concrete, and 152.4cm of earth and log bunker. The PG-7 can plough through brick and concrete walls, leaving a five-centimetre hole, but it will not knock them down.

In Vietnam and Rhodesia, and against the Soviets in Afghanistan, RPG-7s were often used against helicopters. Probabilities of hitting and killing were significant, and the weapon could be effective if fired from ambush at landing helicopters.

Tactical employment

The RPG-7 gunner carries a slung assault rifle and four grenades in a haversack. The assistant gunner is similarly armed. RPG-7s are placed in the centre of each squad strongpoint. Alternative firing positions will be selected and, if time permits, linked by a communication trench or crawlway. The positioning of the RPG-7s gives depth to the defence and creates fire pockets in conjunction with other anti-tank weapons. RPG-7s will hold their fire until the enemy is 300m away.

One or more RPG-7 teams may be located in ambush positions to bring flanking fire on tanks attacking the company frontage. Anti-tank ambushes are often positioned to catch tanks in woods (standard North Vietnamese tactics). Using infra-red sights, the North Vietnamese also used the anti-tank ambush offensively in many night attacks on US armour. The Soviets consider the offensive anti-tank ambush particularly effective when used by reconnaissance forces, and it can also be used to take prisoners or destroy important weapons.

The RPG-7 is used for close-range defence of Sagger ATGMs. The Egyptians located their RPG-7s 150–200m forward of the saggers to catch tanks in combined Sagger and RPG-7 fire. The Soviets have three RPG-7 gunners to protect each pair of manpacked ATGMs and each platoon of three ATGM-armed BRDMs.

With proper clearance, the RPG-7 can be fired from inside buildings and bunkers. It can also be fired from an open APC or BMP hatch, but this makes the gunner an excellent target and decreases the weapon's accuracy, which is why the RPG-7 gunner normally uses an AKMS when mounted. When a squad dismounts, the RPG-7 gunner advances in the middle of the squad skirmish line, next to the squad leader.

The tactics of the Chinese Army rely heavily on the RPG-7, a version of which, along with the RPG-2, is built in China. The Chinese depend on well dug-in infantry armed with RPGs to halt the Soviet armoured offensive with concentrated fire. They have modified the rangefinding stadia of Chinese-built RPG-7s to allow for the lower height of Soviet-built tanks, although an alternative scale for Western tanks is also provided. The Chinese-built sight is reportedly simpler to use and gives better results.

Engagement sequence

Before a PG-7 projectile is loaded, the gunner or assistant gunner must assemble it, screwing the warhead and sustainer motor together with the booster charge. It is then loaded. The gunner then uses the stadia to estimate range, as on a T-62's sight. He tracks the target until it reaches the 500m maximum sighting range, then switches to the gridded lines on the optical sight, estimating the speed and direction of both the wind and the target and adjusting his aim to compensate for both. When his target reaches the double 300m horizontal line, the gunner will fire. Squeezing the trigger ignites the strip powder charge at the base of the projectile, ejecting it from the RPG-7 at a velocity of 177m/sec. Four stabilising tail fins pop open as the projectile clears the barrel. Its warhead arms after it has travelled five metres, and after 11m the rocket sustainer motor ignites, boosting the speed to 294m/sec. If the projectile has not struck anything after it has been in flight for five seconds, when it will have travelled 900m, it will self-destruct. The gunner will observe where the projectile went, correct, reload and fire again. This takes 14sec. The Soviets believe that 300m is the optimum engagement range for the RPG-7, as it reduces target reaction time for suppressive fire or evasive action while still giving time for more shots if the first does not kill the tank. As the first hit will probably not kill the target tank, the gunner should move after firing whenever possible.

Countermeasures

Suppressive fire is the best countermeasure to the RPG-7. An unguided "fire and forget" weapon, it is less vulnerable to suppression than the Sagger. Although the gunner can move immediately after firing, the backblast will often disclose the firing position. The backblast is a one-metre puff of smoke which remains for up to eight seconds, and the rocket ignition produces a bright flash and a second smoke puff. Most countermeasures effective against the

Sagger are also effective against the RPG-7, the exception is evasive action, since the warning time is often too short.

The PG-7's small HEAT warhead can be countered by spaced armour, the first layer of armour detonating the warhead and the second stopping the explosive blast and shaped-charge jet. Many Allied AFVs in Vietnam used appliqué "RPG screens" for armour. If an RPG round hit one of these screens two feet away from the target, its penetration effect would be halved. A screen nine feet away would reduce penetration to 25mm. Almost any type of material can be used to detonate the PG-7. In Vietnam the Americans developed a portable wire mesh screen for the stand-off protection of stationary vehicles. Fifty per cent of the RPG rounds that struck the screen did not detonate at all, thanks to the mesh shorting out the piezo-electric fuse which detonates the warhead. Both the Americans and the Israelis attached lengths of wire mesh RPG screen, which will also "dud out" Saggers, a few feet from the side of their vehicles to increase protection while in combat.

The Blazer reactive armour applied to the Israelis' tanks and the non-reactive stand-off metal armoured screens mounted on their M113s are intended primarily as RPG countermeasures. These systems – especially Blazer – were apparently effective against RPG rounds in the 1982 Lebanon incursion.

RPG-16

Soviet nickname *Grom* **Tube calibre** 58.3mm **Length** 1.1m **Weight unloaded** 10.3kg **Warhead calibre** 58.3mm **Warhead type** HEAT **Weight, complete round** 3.0kg **Muzzle velocity** 130m/s **Maximum velocity** 350m/s **Practical range** 500–800m **Armour penetration (@ 0° obliquity @ any range)** 375mm+ **Rate of fire** 4–6rpm

The RPG-16 is replacing the RPG-7 as the Soviet Army's squad-level man-carried anti-tank rocket launcher, having been in service since the mid to late 1970s.

Externally the RPG-16 resembles the RPG-7 – it is distinguished mainly by its single handgrip under the tube and folding bipod – but its round is quite different from that of the earlier weapon. It is shorter – 600mm long against 905mm – lacking the earlier round's extended "tail". The RPG-16 round is also of smaller calibre but offers better performance, having what is believed to be a doubled shaped-charge warhead. It is a one-piece design, although a cartridge must be attached before use. RPG-16 is reported also to have a HE-Frag round.

The RPG-16 is likely to be significantly more accurate and easy to use than the RPG-7. It is faster, which makes it less liable to crosswind effects than the RPG-7 round. Fin design of the RPG-16 round also appears to be superior, as the higher muzzle velocity results in greater stability.

Paratrooper with fully assembled two-part RPG-16D, airborne version of the standard weapon. *(US Army)*

Aiming the RPG-16 is therefore easier, leading to a significant increase in effective range from 300–500m to 500–800m.

The RPG-16D airborne version can be disassembled into two pieces.

Weapons effectiveness

The RPG-16 is probably capable of a given level of accuracy at 100–200m more range than the RPG-7. The round also probably has a greater chance of killing when it hits. The HE-Frag round is probably slightly less effective

RPG-16 stripped into its component parts. *(Jamiat-e-Islami Afghanistan)*

than the 82mm mortar round, whose tendency to break into a few large fragments is counterbalanced by its plunging trajectory.

Tactical employment and combat usage

The RPG-16 has been slowly replacing the RPG-7 one for one. It is thus used in the same way, as the standard motorised rifle squad anti-tank weapon and as the secondary anti-tank armament of forces using other weapons (providing close-range protection for ATGMs, for instance).

Like the RPG-7, the RPG-16 has been used extensively in Afghanistan, against houses, strongpoints, caves and sangars as well as vehicles. It has been used as a source of dismounted firepower by Soviet motorised rifle, airborne and special forces, and, it is believed, virtually as a light mortar.

RPG-16s seen in Afghanistan often have improved night sights (see page 413). RPG-16s were apparently never issued to the DRA, but the Resistance has captured a number from Soviet forces.

Engagement sequence and countermeasures

The RPG-16 engagement sequence is probably similar to that of the RPG-7. When loaded, the round does not project beyond the muzzle. The effect of crosswinds is less drastic, but the parameters remain similar.

RPG-7 countermeasures are also likely to work against the RPG-16, although its more effective warhead is harder to defeat.

Above: Fully assembled PG-16 rocket-propelled HEAT grenade for the RPG-16. *(Christopher Foss)*

Below: RPG-18 captured in Afghanistan, where the weapon is widely used by both sides. This example is in unextended carry position in its launch tube. *(Jamiat-e-Islami Afghanistan)*

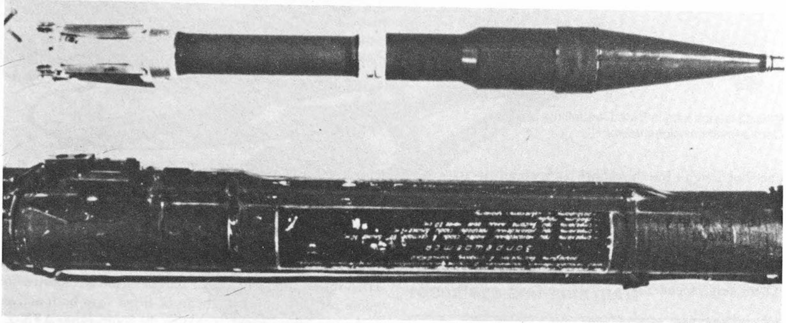
RPG-18

Introduced 1977 **Warhead** HEAT **Launcher construction** fibreglass **Launcher length (closed)** 700mm **Launcher length (extended)** 1.046m **Rocket diameter** 63.5mm **Rocket length (inc fins)** 690mm **Rocket weight** 1.44kg **Total weight** 2.72kg **Max sight range** 200m **Max effective range** 135m **Muzzle velocity** 114m/s **Time to ready to fire** 10sec **Rear backblast area** 30m²

The RPG-18 is basically a copy of the US M72A2 LAW 66mm single-shot, disposable anti-tank weapon. Copying has been standard practice when a need for a weapons system has arisen and no Soviet equivalent is immediately available; its application to army hardware has however been limited until recent years. The Soviets first used disposable single-shot anti-tank weapons when they captured large numbers of German *Panzerfausts* during the Second World War. *Panzerfaust* factories were kept in operation post-war, the weapon being designated RPG-1 in Soviet service.

The RPG-18 is probably only an interim measure, in use until a more advanced design capable of dealing with tanks such as the M1 Abrams can be fielded. Although it is not a state-of-the-art weapon, the RPG-18 is inexpensive and easy to produce.

The RPG-18's rocket is slightly longer and heavier than that of the US weapon, although the bore has been copied. According to East German sources, the RPG-18 has a new



An RPG-18 launch tube and projectile. The side of the launch tube is marked with very full instructions on the use of the weapon. *(US Department of Defence)*

shaped-charge warhead, a claim that is borne out by the fact that it has greater penetration than would otherwise be expected from a weapon of 63.5mm calibre. The RPG-18 is thus more likely than LAW to kill tanks that it hits. There is another difference between the two weapons: once the RPG-18's tube has been extended into firing position from the collapsed carrying position, the tube cover folded down and the sights snapped up, it cannot be disarmed and must therefore be fired.

Like LAW, the RPG-18 is a throwaway weapon, although in peacetime the empty tube is retained for recycling. The Soviets have also copied LAW's subcalibre firing device for training purposes. A large decal applied to the outer tube of each RPG-18 is designed to give even untrained troops a good idea of how to use the weapon. Because of its compact size and protective plastic covering, the RPG-18 is easily carried.

Weapons effectiveness

The effectiveness of the RPG-18 is believed to be similar to that of the M72A2 (see table on page 118).

Tactical employment

The RPG-18 replaces the RKG-3M HEAT hand grenade as the anti-tank weapon of the individual Soviet soldier. It does not replace the RPG-7 or RPG-16. Like the RKG-3M, it is issued as ammunition. It is packed in eight-weapon crates. Each motorised rifle or airborne platoon can be expected to share the contents of at least one crate.

Combat usage

The Soviets have made fairly extensive use of the RPG-18 in Afghanistan, where it is used against bunkers, houses and fortified positions. An RPG-18 round will readily demolish a sangar and anyone behind it, whereas a burst of small-arms ammunition would only splatter against the rocks. The Soviets have also used the RPG-18 against individual Afghan snipers.

Engagement sequence

To fire an RPG-18, the soldier first extends the tube like a telescope. He then extends the trigger and safety catch, rear peep sights and folding front sight with range calibrations at 50m intervals up to 200m range, and removes the front and rear tube covers. The weapon must then be armed, whereupon it can be fired prone, kneeling or standing, provided that the backblast area is clear. The piezo-electric nose fuze of the rocket is armed at 2–15m range. The rocket also has a base detonator. If the fuze is not activated after four to six seconds' flight time, the round self-destructs.

Foreign production

The Czech-produced RPG-75 is a different weapon, although used in a tactically similar way.

RPG-22 80mm light anti-tank weapon

The RPG-22 is reported to be an improved version of the RPG-18 that was seen in action in Afghanistan in 1986. It retains the basic configuration of the RPG-18 – telescoping launch tube, pop-up sights, one-shot design – but the

RPG-22 launch tube in folded (travelling) position. *(Jamiat-e-Islami Afghanistan)*

one-shot design – but the calibre is apparently increased to 80mm, allowing a larger shaped charge to be delivered. The latter may be the same as that used in the Soviet 80mm aircraft rocket or the PG-7M anti-tank round. While the sight is ranged to 250m, effective range is not likely to greatly exceed that of the RPG-18. Launcher length is 0.85m, tube extended.

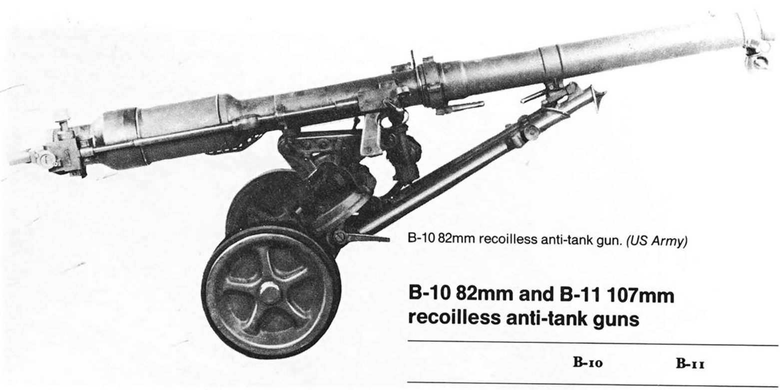
SPG-9 73mm recoilless anti-tank gun

Calibre 30cal **Weight** 46.1kg (on two-wheel removable towing carriage), 36.6kg (on firing tripod) **Length (travelling)** 2.1m **Rate of fire** 6rpm **Effective range** 800m **Max range** 1,960m **Ammunition types** PG-9 HEAT, OG-9 HE **Initial muzzle velocity** 435m/sec **Max muzzle velocity (with rocket)** 700m/sec **Shell weight** 3.6kg (HEAT), 4.5kg (HE) **Armour penetration** (HEAT) 400mm **Crew** 3 **Carried in** APC

The tripod-mounted, smooth-bore, recoilless SPG-9 replaced the B-10 82mm and B-11 107mm recoilless anti-tank guns from 1969. The SPG-9 is similar to the 73mm 2A20 gun mounted in the turret of the BMP and BMD, the main difference being in the propelling cartridge. While it is man-portable, a pair of SPG-9s is normally carried in an APC, though it can only fire from its tripod and not from an APC hatch. Its rocket-assisted HEAT projectile has a high muzzle velocity, boosted to 700m/sec by the rocket. It can be fitted with both active and passive night sights, including the 800m-range APN-2. The shell self-destructs at maximum range. The SPG-9D, a lightened version that can be packed by one man, is used by air assault and airborne units.

The PGO-9×4 telescopic day sight's reticle for the SPG-9 is similar to that of the BMP's 1PN22M1. The PG-9 HEAT round for the SPG-9 produces a sizeable backblast when fired, with another flash when the rocket ignites about 20m downrange. The PG-9 differs from the shell used by BMPs in having a semi-combustible rather than a

73mm SPG-9 anti-tank weapon in firing position. *(US Army)*



B-10 82mm recoilless anti-tank gun. *(US Army)*

steel cartridge. The SPG-9 can be transported on its removable two-wheel carriage or carried in an APC. It takes about 1min to set it up for firing.

Combat usage

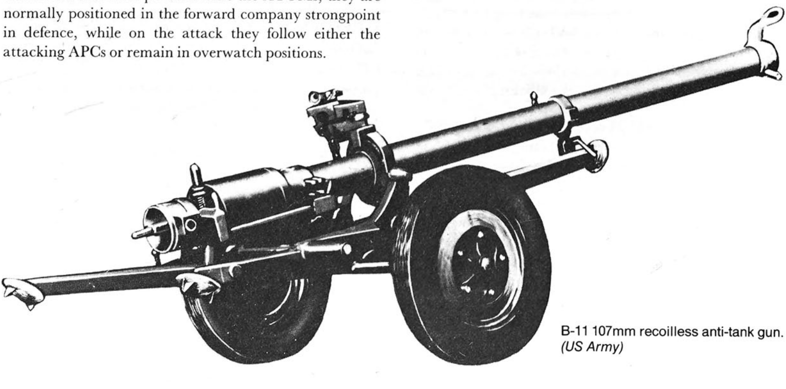
The SPG-9 has seen combat in Afghanistan and some may have been supplied to Ethiopia in 1978. Its effectiveness would be approximately the same as that of the 2A20, as would its engagement sequence and the countermeasures effective against it.

Tactical employment

Two to six SPG-9s are organic to each motorised rifle battalion's anti-tank platoon. Like the ATGMs, they are normally positioned in the forward company strongpoint in defence, while on the attack they follow either the attacking APCs or remain in overwatch positions.

B-10 82mm and B-11 107mm recoilless anti-tank guns

	B-10	B-11
Calibre	20cal	28cal
Weight (firing)	72.2kg	305kg
Length (travelling)	1.91m	3.56m
Width	0.71m	1.45m
Rate of fire	5–6rpm	5rpm
Max range (HE)	4,470m	6,650m
Effective AT range	390m	450m
Ammunition types	BK-881 HEAT, OF-881A HE	BK-883 HEAT, OF-883A HE
Muzzle velocity (HEAT)	322m/sec	400m/sec
Muzzle velocity (HE)	320m/sec	375m/sec
Shell weight	3.6kg-HEAT 4.5kg-HE	7.5kg-HEAT 8.5kg-HE
Armour penetration (HEAT)	240mm	380mm



B-11 107mm recoilless anti-tank gun. *(US Army)*

BRDM-1 with Swatter mount. *(Department of Defence)*

Both the B-10 and B-11 have largely been withdrawn from Soviet service, although they probably remain in low-readiness formations and for training. Both weapons are smooth-bore, introduced in the early 1950s. Both fire fin-stabilised HEAT and HE rounds and are towed by the muzzle on two-wheel carriages that can be broken down into a simple tripod if the weapon has to be carried or emplaced. The B-10's breech opens horizontally, while the B-11's swings down. The B-10 is fitted with a PBO-2 sight, the B-11 with a PBO-4.

Originally intended to equip battalion anti-tank platoons and regimental anti-tank companies respectively, these two guns have been unsuccessful. After the poor performance of Arab B-10s in the 1967 War they were reportedly withdrawn from service in at least some Soviet battalions and replaced with 57mm anti-tank guns from reserve stocks as an interim measure pending arrival of the SPG-9. The B-11 is large and bulky and difficult to traverse. Both weapons were also used in combat by the North Vietnamese Army, and by the Arabs in 1973. The DRA military has used the B-10 in action in Afghanistan, and the Resistance has used substantial numbers as well as Czech and Chinese-built 82mm recoilless weapons.

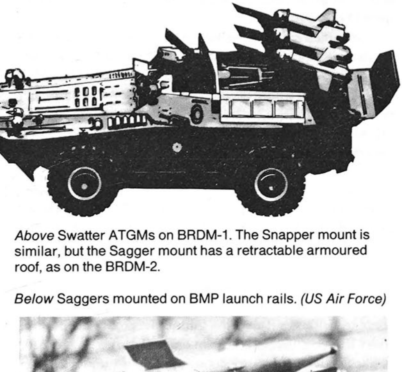
First-generation ATGMs

NATO designation	AT-1 Snapper	AT-2 Swatter	AT-3 Sagger
Soviet designation	3M6 PTUR-61 *Shmyel*	PTUR-62 *Falanga*	9M14M PTUR-64 *Malatyuka*
Length	1.14m	1.14m	0.815m
Diameter	0.132m	0.132m	0.12m
Weight of missile	24kg	29.5kg	11.3kg
Min range	500m	500m	300m
Max range	2,500m	3,000m (3,500)	3,000m
Velocity	90m/sec	150m/sec	120m/sec (150)
Warhead	HEAT, 5.28kg	HEAT	HEAT, 2.7kg
Armour penetration	350mm	480mm (500)	400mm
Control	Wings	Fins	Nozzles
Time to max range	30 sec	23.2sec (27)	27sec (21)

Figures for later versions are shown in parentheses where they differ. The Swatter version is the Swatter-B, as used on some helicopters; the Sagger version in parentheses (Sagger-B) is the improved version mounted on some BRDMs.

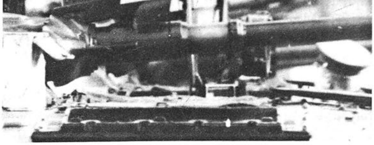
The most skilfully aimed tank gun loses accuracy at long range. Dozens of variables, impossible to compensate for in the heat of action, affect the flight of a shell. Even the earliest Soviet ATGMs, however, can attain (at least in theory) an 89% hit probability at 2,500m range, much higher than the finest tank gun. The key to this difference is that ATGMs are guided, unlike the shells. The gunner literally flies them to their targets.

The Soviets realised the revolutionary potential of ATGMs when they were introduced in the mid-1950s. This potential first became evident in the first days of the 1973 Middle East war, when the Israeli armour attacked the Sagger ATGM and RPG-7 anti-tank teams screening the Egyptian bridgehead across the Suez Canal. In the words of one Israeli tank commander: "We were advancing, and in the distance I saw specks dotted on the sand dunes. I couldn't make out what they were. As we got closer, I thought they looked like tree stumps. They were motionless and scattered across the terrain ahead of us. I got on the intercom and asked the tanks ahead what they made of it. One of my tank commanders radioed back: 'My God, they're not tree stumps, they're men.' For a moment, I couldn't understand. What were men doing out there – standing quite still – when we were advancing in our tanks towards them? Suddenly, all hell broke loose. A barrage of missiles was being fired at us. Many of our tanks were hit. We had never come up against anything like this before . . ."



Above Swatter ATGMs on BRDM-1. The Snapper mount is similar, but the Sagger mount has a retractable armoured roof, as on the BRDM-2.

Below Saggers mounted on BMP launch rails. *(US Air Force)*



In the first 72 hours of the war all of Mandler's armoured division and a brigade of Adan's armoured division was decimated. The Sagger had shown the potential of the ATGM.

The first Soviet ATGM, the AT-1 Snapper, was large, primitive, heavy and slow. It entered service in the late 1950s and was normally mounted in a rear-facing quadruple mount on a light truck or a triple mount on a BRDM-1. The version on the GAZ-69 jeep was designated 2P26 by the Soviets, that on the BRDM-1 2P27. Control was by means of a remote joystick which could be up to 50m away, although it was normally in the cab of the truck. It has probably been phased out of Soviet service but is still used in Yugoslavia.

The Snapper was followed into service by the radio-controlled AT-2 Swatter-A and Swatter-B and the wire-guided AT-3 Sagger. The Swatter is mounted on Hind-A and Hind-D helicopter gunships, in triple mounts on BRDM-1 scout cars and in quadruple mounts on BRDM-2 scout cars, although it is apparently being superseded by the Sagger and second-generation ATGMs in this role. The BRDM-1 with Swatter remained in Soviet service in 1987.

The Sagger is the standard Soviet ATGM. It is mounted on BMPs and BMDs, on a sextuple mount on a BRDM-2 or -1 scout car, and is man-portable in an easily carried "suitcase" which contains two rounds and a missile control unit. Since 1973 a slightly improved Sagger has been mounted on BRDMs. It is 25% faster than the standard Sagger, taking 21sec to fly to 3,000m instead of 27sec. Designated Sagger-B by NATO, it is not used in BMPs, BMDs or suitcases.

By the mid-1970s the Soviets had started to upgrade Sagger to semi-automatic command line-of-sight (SACLOS) guidance, although this appears to have been limited to those mounted on BMPs and BMDs, excluding the suitcase variants. Designated Sagger-C by NATO, the SACLOS-guided variant has a second tracking flare, for the infra-red tracker.

Using first-generation ATGMs

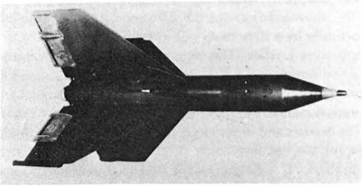
The Snapper, Swatter and Sagger require the gunner to "fly" the missile to its target. The gunner tracks the missile virtually by a flare in its tail, correcting its course with a miniature joystick. This requires a high level of dexterity, co-ordination and training. Weapons putting such a high premium on gunner skill are perhaps better suited to a professional army's long-serving experienced personnel. The Soviets and other large, conscript armies, like that of Egypt, do not have such soldiers available in sufficient numbers. The Soviets select potential ATGM gunners

BRDM-1 with retractable Sagger mount extended. *(Department of Defence)*

from those with the best co-ordination in each incoming crop of conscripts, who undergo extensive training in simulators. A gunner must fire 2,300 simulated Sagger rounds to qualify as proficient. Owing to the expense, each gunner might fire only one Sagger as a graduation exercise, but he must practise with 50–60 simulated rounds a week to stay proficient. Even at the height of the 1973 War, the Egyptians brought truck-mounted simulators up to the front lines so that Sagger gunners could fire 20–30 simulated rounds a day when not actually engaging the Israelis. The widespread provision of ATGM simulator vans throughout the Soviet Army suggests that they would do the same thing.

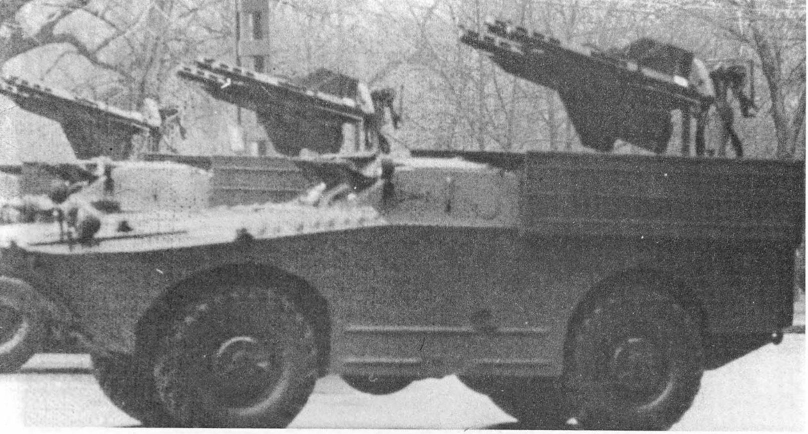
The Sagger can be guided from under armour on the BMP, BMD and BRDM, with the gunner sighting through his vision block. Suitcase and BRDM-2-mounted Saggers can also be controlled remotely. This apparently does not apply to the SACLOS-guided Sagger, which requires the infra-red tracker to be on the gunner's line of sight. This may be one of the reasons why the SACLOS-guided Sagger, initially at least, was confined to the BMP and BMD.

AT-1 Snapper ATGM. *(Missile Intelligence Agency)*



The launch controls are attached to a wire – 15m for the suitcase version, 80m for the BRDM-2 – and the gunner can position himself away from the launcher, at which suppressive fire would be aimed. It also allows the launcher to be put in defilade, or on a reverse slope. All that need be exposed is the missile control box's 8× monocular periscope eyepiece, measuring 10 × 2.5cm. However, when the gunner is "flying" the Sagger from a remote location not directly between the launcher and the target, it becomes less accurate, as the gunner must take the lateral offset into account when flying the missile. This also increases the "capture" range (the minimum range at which the missile can be brought under control). If the gunner is co-located with the launcher the missile can be captured at its 300m minimum range and guided from there to its target. But if the gunner has offset his position away from the launcher he can only capture a Sagger after it has flown at least 500–800m, or 1,000m under combat conditions.

It takes five minutes to deploy a single suitcase Sagger for action and 12 minutes for a full four-missile team to set up. BRDM-2 mounted Saggers can be elevated and ready for action in one minute. A single Sagger control unit can fly only one missile at a time, but a BRDM-2 can fire another missile within five seconds of the first round hitting the target. The suitcase Sagger and those on the BMP and BMD must be reloaded first, which takes about 90sec.



BRDM-1s armed with Snapper ATGMs. *(Department of Defence)*

Performance and capabilities

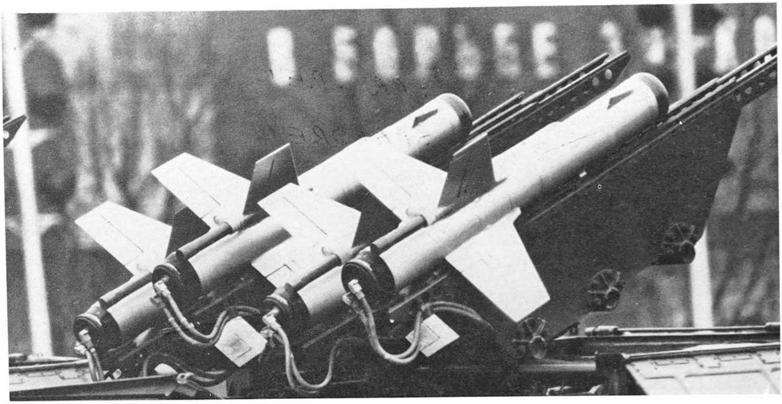
All Soviet first-generation ATGMs are slow in flight. If they were any faster, there would not be enough time for the gunner to correct their flight. This gives targets time for countermeasures and means that many targets will move out of the gunner's field of vision, covered by blocking terrain. While this was not a problem in the sands of Sinai, it would be very important in West Germany, where tanks will move from cover to cover. At 1,500m range a tank moving at 21km/h would have to be exposed in sight for 150m for a Sagger gunner to acquire the target and fire (which a proficient gunner might do in ten seconds), and fly the missile to the target. Even on the flat North German plain, a tank moving from cover to cover would only be exposed for a 150m interval 30% of the time. At 3,000m range on the North German plain the tank would be able to reach cover before the Sagger reached it 90% of the time. In southern Germany the terrain is denser and Sagger use even more difficult.

On the modern battlefield anything that can be seen can be hit, and anything hit, destroyed. Unlike some ATGMs, such as the US TOW and Dragon, Soviet first-generation ATGMs do not have a backblast or muzzle flash when launched, just a cloud of grey smoke and a loud roar which are difficult to detect under battlefield conditions. In the 1973 War not a single Sagger launch was spotted. But as the Sagger is large and slow-moving, 70% of the Israeli tank commanders could detect the missile or its short smoke trail in flight and take countermeasures.

Both Sagger and Swatter are only effective in the direction in which they are pointing when on their launchers. The effective area for Sagger is a cone 3,000m in length and 2,000m wide at maximum range, narrowing in width to 1,170m at 1,000m range and only directly in front of the launcher at 300m range. Owing to the weapon's radio control, the effective area of the Swatter is broader and resembles a semi-circle. Both missiles can switch targets within their fields of fire during flight. The Sagger is armed from the moment of launch, even though its course cannot be corrected until it reaches its minimum range, while the Swatter does not arm until it reaches its minimum range, precluding its use as a "giant RPG-7" in an emergency.

While the primitive Snapper was apparently unreliable – the Egyptians reportedly experienced a 25% malfunction rate – other first-generation Soviet ATGMs are simple and and reliable. In US Army tests the Sagger's malfunction rate was negligible. However, the guidance wires will occasionally break, and it has been reported that firing across bodies of water or under power lines will disrupt its guidance system.

In summary, Soviet first-generation ATGMs are simple, reliable, easily used weapons which, when presented with suitable targets in the open, can be accurate at long range. However, accuracy is often reduced in combat conditions because they are susceptible to countermeasures and suppressive fire, and because they lack responsiveness in tracking targets. This has been reflected in the worldwide move away from command-guided ATGMs. Soviet systems lack autopilots, incorporated in the West to reduce overcorrection, and the accuracy figures shown here were apparently not attained under combat conditions. In fact it is estimated that accuracy average was only 25%,



Swatter ATGMs, as mounted on a BRDM-1. *(Department of Defence)*

declining to as little as 2% in some situations. It is estimated that the SACLOS Sagger-C has a combat hit probability of about 50%, similar to that of US TOWs against North Vietnamese tanks or British Milans against Argentinian bunkers.

Combat usage

Several Egyptian Snapper companies were deployed in Sinai in 1967, and these destroyed at least one Israeli tank on June 7. In 1969, during the Middle East War of Attrition, Saggers destroyed two M-48 tanks during a skirmish at the Port Said causeway. In early 1973 the Syrians knocked out several Centurions with Saggers in border fighting. Although the Israelis knew about Sagger, they did not understand its potential. Thus the surprise effect of massed Saggers greatly increased their effectiveness until the Israelis were able to devise countermeasures.

The Sagger was first used in Vietnam on April 23, 1972 and inflicted considerable losses on the South Vietnamese 20th Tank Regiment. The survivors improvised successful countermeasures, including dodging and suppressive fire, but no one seemed to take notice. North Vietnamese Saggers have been used throughout Indochina.

Egyptian commandos used suitcase Saggers against Libyan armour in 1977. Cuban and Ethiopian forces used Saggers in the Ogaden in 1977, including those mounted on BMDs. The Swatter has possibly never seen action, although Hind-A and Hind-D helicopters have been spotted carrying Saggers and Swatters in Afghanistan.

Modified first-generation ATGMs are reported to have been used in Afghanistan to carry communication lines between peaks, the gunner landing the missile by triggering a parachute. Standard Saggers have been used in Afghanistan throughout the war. In addition to those mounted on BMDs and BMPs, the Soviets have used suitcase Saggers against stone houses and sangars. The Resistance has not made use of captured Saggers.

Iraqis have fired Saggers from suitcase mounts, BRDMs and helicopters in the Iran-Iraq war. Iran is reported to have used substantial numbers of Chinese-produced Saggers against Iraqi bunkers in January 1987.

Accuracy of Soviet first-generation ATGMs

	Range (metres)						
	300	500	1,000	1,500	2,000	2,500	3,000
Snapper	0%	54%	73%	82%	87%	89%	0%
Swatter	0%	0%	90%	90%	90%	90%	90%
Sagger	25%	60%	87%	87%	87%	87%	87%

The percentage represents the approximate probability of a hit against a stationary M60A1 tank from a stationary ATGM launcher (ATGMs cannot be fired on the move). Swatter figures are estimates but close. If a Sagger hits an M60A1 it has a 69% chance of knocking it out, while a Snapper or Swatter has a 67% chance. Semi-automatic guidance Saggers would be more accurate.

The Soviets have tested Saggers against helicopters. While helicopters are unlikely to remain stationary long enough to be acquired and hit, the Soviets fear ATGM-firing gunships, and all available weapons, including Saggers, will be fired at them.

Sagger-launcher BRDM-2, showing the sextuple launch rails under the retractable armoured roof. Also evident are the BRDM's retractable amidships wheels and trim vane for swimming. *(US Army)*

Soviet first-generation ATGMs have reduced effectiveness at night and in limited visibility. None have night sights or any type of infra-red device. They must rely on flares or other illumination, which would still make it difficult to track both target and missile. This is a drawback because of the need for 24-hour operations, and the fact that fog reduces visibility to under 1,000m one morning out of three during autumn and winter in West Germany. Mirage conditions in the desert also reduce ATGM accuracy and effectiveness.

Tactical employment

In BTR-60/70/80-equipped battalions that use older equipment the two suitcase Saggers are dug into front-line strongpoints. BRDMs from the regimental anti-tank company will be deployed behind the battalion defensive positions or as part of the regimental anti-tank reserve.

The Soviets do not emphasise positioning ATGMs to achieve flanking fire, due to their superior armour-penetration ability. This allows the ATGMs to engage at longer range but makes them more vulnerable to return fire, although alternative firing positions are provided.

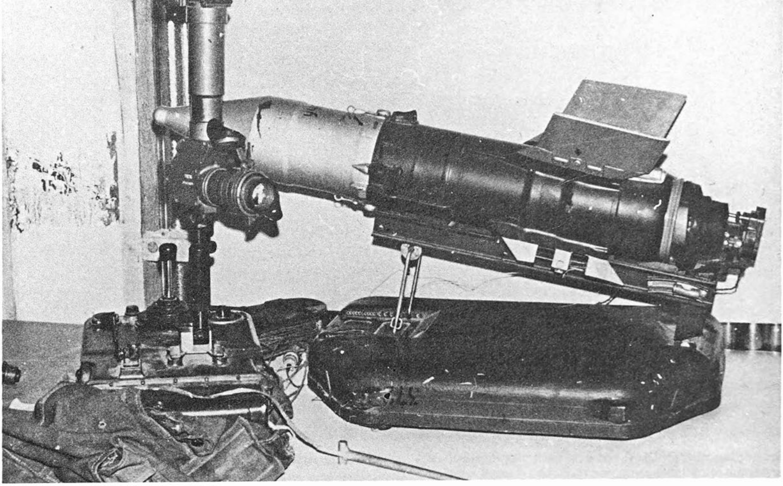
A three-man Egyptian Sagger team would include two gunners with four Sagger rounds. The third man, with an RPG-7, would be 150–200m in front of the Saggers. These teams were supported by light machine guns, Sagger reload carriers and SA-7 SAM gunners. It was easy to site these weapons with overlapping fields of fire in Sinai. Soviet *desants* and other units behind enemy lines will probably use similar Sagger teams against enemy armour heading for the front.

Because Soviet first-generation ATGMs cannot be fired from the move or short halt, regimental BRDM ATGM launchers will fire from overwatch positions in an attack, using the remote missile control unit to reduce exposure. Each battalion's anti-tank platoon will either overwatch or advance in two APC's 1,000–2,000m behind the assault companies. It is normally employed as a complete unit in the attack, as an anti-tank reserve or to consolidate positions gained by the battalion. The BMPs and BMDs that have Sagger as their primary anti-tank weapon beyond 800m range will open fire at long range while defending. Only overwatching BMPs or BMDs will fire Saggers in the attack, as it would be too dangerous for advancing vehicles to stop and fire within range of the enemy.

Engagement sequence

Saggers are simple to prepare for firing. A suitcase Sagger's launch rail is first removed from the suitcase, where it is stored in collapsed form, and erected. The body of the round is next removed from the suitcase and put on the launcher, the separate warhead being attached. The fins are then extended to the open position. Finally, the missile control box is set up and attached to the launcher. Each box can control two launchers. In a BRDM the retractable roof covering the missiles is elevated. On a BMP or BMD the gunner must seat a round and launch rail over the gun tube, using a stick to deploy the fins.

The gunner next acquires the target in his eight-power



A man-portable "suitcase" Sagger deployed with its monocular sight and control joystick unit. The warhead is a separate unit, as can be seen from the clips holding it in place. Only two of the four tail fins are attached here; all would have to be attached for launching. *(Tom Woltjer)*

sight, which, like the RPG-7 sight, is gridded with lines for range and wind/lead corrections. Once the target is visually spotted, identified as hostile and acquired in the sight, the gunner may fire. The missile then flies straight ahead to its minimum range, a magnesium flare in the rear of the missile igniting to aid the gunner in tracking. When the missile reaches its minimum range he must "capture" it, bringing it into the sight picture. He does this by transmitting commands to the missile through a joystick. The electrical control impulses are carried to the missile by fine wires which unroll as it flies or, in the Swatter, are transmitted by UHF radio commands. Theoretically, all the gunner has to do is ensure that the missile's flare remains superimposed over the target on his sight picture until it hits.

SACLOS-guided Sagger has an engagement sequence similar to that of Spigot and Spandrel.

Countermeasures

Soviet first-generation ATGMs are vulnerable to countermeasures. Many of the countermeasures developed by the Israelis during the 1973 War have been adapted and improved by the US, British and other NATO armies.

The Israelis discovered that the best countermeasure against Saggers was to destroy or suppress them by using combined-arms tactics. They increased their use of artillery against the suitcase Sagger gunners, who were without cover. Reorganised to meet the Sagger threat, Israeli armour units now had an even mix of tanks and armoured personnel carriers mounting at least three

Nicknamed "the pram" by its Soviet crews, a quadruple Snapper mount on a modified GAZ-69 jeep. The gunner's sight is at the upper right-hand corner of the cab. *(US Army)*

machine guns. They would advance in checkerboard formation, tanks and APCs alternating. If heavy ATGM or RPG fire was encountered, the APCs would lead the advance, spraying suppressive machine gun fire while the tanks supported them with high explosive or blinded the enemy with smoke or white phosphorus. If the advance was halted, the infantry would dismount and clear the Saggers out.

Advancing Israeli armour in the later stages of the 1973 War also used the "Sagger watch" technique now adopted by NATO. Each tank and APC would search a key point of terrain where a Sagger might be located. When a Sagger was spotted in flight, the watching vehicle would give a warning to whoever appeared to be the target and would immediately fire in the direction of the Sagger launch, hoping to disturb the gunner's concentration, make him lose control of the missile and obscure his vision with the dust raised by firing. Meanwhile, the target would take evasive action. Forces advancing against suspected ATGM positions can also use "bounding overwatch", with half of the force moving while the other half remains in overwatch positions, their weapons trained on likely enemy positions.

The most effective countermeasure against any ATGM is suppressive fire. Joystick-controlled ATGMs are especially vulnerable to gunner distraction, and the threat of powerful return fire will frequently keep a gunner from firing at all. Smoke is the best ammunition for suppressing ATGMs, since the gunner cannot hit what he cannot see. This has greatly increased the importance of smoke shells on the modern battlefield. White phosphorus is also good against ATGMs, as it combines smoke and explosive effect.

Rather than charge an enemy, as the Israelis did in the opening days of the 1973 War, an armoured force today will reduce its vulnerability by limiting exposure, moving from cover to cover, through blocking terrain, or during periods of reduced visibility (although this is impractical in the desert). When moving in the open vehicles stay near cover such as woods, so that they can dodge an incoming ATGM by turning into the woods, where they would be concealed from the gunner. Hull-down tanks can dodge ATGMs spotted in flight by simply reversing down the slope and letting it pass overhead. Even if there is no cover, a tank can still out manoeuvre a first-generation ATGM. It is difficult for the gunner to correct for sudden, sharp moves by the target: a turn to the right or left by the target in the last four or five seconds before impact cannot be compensated for, and the missile will go past. Tanks can also dodge these ATGMs by following an erratic, swerving path. None of the first-generation Soviet ATGMs has an autopilot, so the gunner's natural tendency is to overcorrect while trying to keep the missile on target, and thus lose control. US Army officers estimate that dodging techniques alone can reduce first-generation ATGM effectiveness by at least 50% and possibly by as much as 70%.

The wire-guided Sagger and Snapper are immune to electronic countermeasures, although they use the same vulnerable piezo-electric nose fuze as the RPG-7. The radio-controlled Swatter can be jammed, although the gunner has a choice of three different frequencies on which to transmit radio commands.

Second-generation ATGMs

	AT-4 Spigot	AT-5 Spandrel	AT-6 Spiral
Soviet nickname	*Fagot*		
Max range	2,000m	4,000m	5,000m
Min range	70m	100m	500m
Velocity	185m/sec	185m/sec	450m/sec
Warhead	HEAT (3kg)	HEAT (4kg?)	HEAT (10kg?)
Armour penetration	500–600mm	500–600mm	600–700mm
Weight (missile)	7kg	10–12kg	25kg
Max flight time	11sec	15sec	20sec
Introduced	1973–6	1972–4	1978
Diameter	120mm	130mm	140mm
Length	0.98m	1.0m	?

All figures approximate.

The second generation of Soviet ATGMs – along with SACLOS-guided Sagger – provided the Soviet Army with a substantial increase in anti-tank capability from the mid-1970s. These weapons are a prime example of how the Soviets have been able to narrow the technology gap, possibly by using "transferred" Western expertise. While not unsophisticated, they are easier to use under combat conditions than their first-generation predecessors. Soviet second-generation ATGMs first appeared when the AT-5 Spandrel was seen in a quintuple mount on a BRDM-2 in

the November 1977 Red Square parade. Soon after the man-carried AT-4 Spigot was reported in service. These new ATGMs are now spread throughout Soviet forces in eastern Europe and the western USSR as well as Warsaw Pact forces, although there were still large numbers of first-generation systems in service in the mid-1980s.

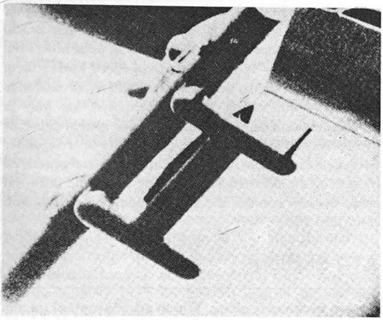
These weapons appear to be comparable to Western ATGMs. The Spigot launcher's only outward differences from its Milan equivalent lie in its smaller sight and the placement of the goniometer and computing mechanism under the launch rail. The Spigot ground mount has a maximum elevation of about 35° – almost twice that of comparable Western systems – which would allow it to be used against helicopters at over 1,100m altitude at its maximum range. They use the same semi-automatic command line-of-sight (SACLOS) system as the US Dragon and TOW and the European Milan and HOT, and share their relatively high speed. A large tracker head is mounted on the BRDM-2 AT-5 carrier, and may include a night sight. The wide-angle periscope, used for target acquisition while "buttoned up," is also mounted on the roof of the BRDM's crew compartment. Ten reload missiles are carried. It has been reported in some publications that the reason these missiles are so similar to Western design is that they are developed from the Milan. Undoubtedly, the Soviets have had the opportunity to acquire plans and, more recently, samples from export customers.

Similarly, Spandrel is believed to be in large part a copy

Above: AT-4 Spigot gunner prepares to fire as his ammunition carriers give support with their Kalashnikovs. *(US Department of Defence)*

Below: Quintuple AT-5 Spandrel mount on a BRDM-2 scout car. The gunner's sight is extended on the right-hand side of the vehicle. The reload hatch is just visible behind the ATGMs, as is the modified rear deck of the BRDM. *(Missile Intelligence Agency)*

Spiral ATGM launch tube on a Hind-E. The missile is believed to be closer in design to Spigot or Spandrel than to earlier Soviet ATGMs. *(US Army)*



of HOT. Spigot is stored in a tube, 1.2m long and 0.13m in diameter, and is fired from a light tripod with a periscopic sight; both tube and sight can be rotated manually on the tripod. The Spandrel launch tube differs only slightly.

Spigot has been seen mounted, alongside Spandrel, on BRDM ATGM launch vehicles. This ability to mix the two shows how similar these systems are. It also allows BRDMs to carry the cheaper and lighter smaller design when feasible.

AT-6 Spiral arms Hind-E/F and Hip-E helicopters and, presumably, more recent designs. Tube-mounted, Spiral replaces Swatter on the twin launcher carried on each outrigger of these helicopters. First seen in East Germany in 1978, Spiral is a large, fast missile. It uses a SACLOS system with infra-red missile tracking, as do other Soviet second-generation ATGMs, but, unlike them, employs a radio link rather than a wire to pass commands. The same system is used in the improved AT-2C version of Swatter.

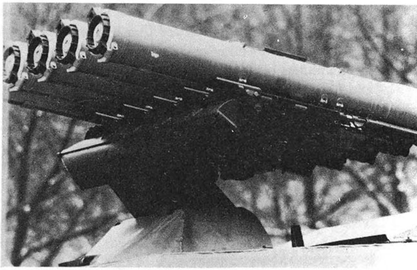
Combat usage

Syrian Spigots have been used in Lebanon, mainly against strongpoints, and a number were captured by the Israelis at Bhamdoun on the Beirut–Damascus Highway. Second-generation ATGMs have seen combat in Afghanistan. AT-4s have been used by Soviet heliborne forces in Afghanistan in 1986–88, and by Iraq (against Iranian strongpoints) and probably by Libya (Chad) and Polisario guerrillas (Sahara).

The Spigot and Spandrel would probably have about a 70% chance of hitting a stationary tank target between their minimum range and 300m. Between that point and their maximum range their hit probability would almost certainly be 89% to 93%. The Spiral's hit probability would also be close to 90%. These figures represent maximum hit probabilities. Combat experience with US TOWs and British Milans suggest that the actual rates might be half as much. Given a hit on an M60A1, probability of a kill would be at least 70%, and probably higher for the large Spiral.

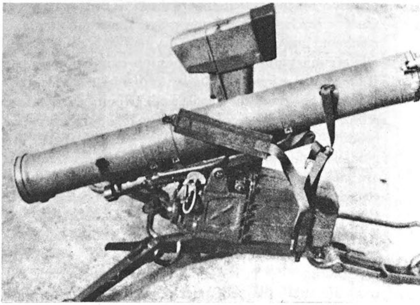
Tactical employment

It appears that second-generation ATGMs will be used in the same way as the weapons they supplant: Spigot and Spandrel being used as suitcase and BRDM-mounted Saggers respectively, while the Spiral is used like the



Above: AT-5 Spandrel ATGMs in their launch tubes, as mounted on BRDM-2 scout cars. Some East German BRDMs mount three AT-4s and two AT-5s. *(US Army)*

Below: AT-4 Spigot launcher. Its maximum elevation of 35° or more may give it an anti-helicopter capability as well as permitting it to engage tanks on higher ground.



helicopter-mounted Swatter B. Spandrels mounted on UAZ-469s are used by Soviet and Czech airborne units.

Soviet second-generation ATGMs have a substantial anti-helicopter capability, and Soviet Army training is believed to include the engagement of helicopter targets. The Spigot ground mount has a maximum elevation of 35–40°, greater than that of comparable Western ATGMs (Milan's maximum elevation is 20°). While this could have been intended to help clear obstacles on launching, it is more likely that an anti-helicopter capability was envisaged. At 35° elevation, a Spigot could reach a helicopter at 1,147m altitude at its maximum 2,000m range.

ATGMs have some advantages as anti-helicopter systems. There is no warning to the helicopter crew that it is being tracked, in contrast with radar-directed weapons. The electronic and infra-red countermeasures carried by helicopters are not designed for use against ATGMs, so that the missiles must be evaded. While the missiles themselves are markedly slower than SAMs – limiting them to shots at hovering or slow-moving helicopters – the sheer number of Soviet ATGMs makes them a serious anti-helicopter threat.

The Saggers mounted on 73mm-armed BMPs and BMDs are being replaced by tube-mounted Spigots. 30mm-armed BMP-2s carry tube-mounted Spandrel. BRDMs can carry and fire a mix of Spigots and Spandrels, the latter being the more usual armament, especially in the Soviet Army. AT-4s are also mounted on LuAZ-969 light trucks.

Engagement sequence

The gunner of the Spigot and Spandrel must first sight the target in his telescopic sight, estimated at ten-power. When the target is lined up in the cross-hairs he can fire. The missile is ejected from the launch tube by a piston, and coasts until clear of the gunner. The sustainer rocket engine then starts, creating a small backblast which is probably much less than that of the US TOW or Dragon. Once it reaches its minimum range, the semi-automatic command line-of-sight guidance system takes control, and all the gunner must do is keep the cross-hairs on the target. If the guidance system is similar to that on the Milan, an infra-red beacon in the missile's tail gives its position to a sensor in the missile guidance unit. If the missile is not heading directly where the cross-hairs indicate, the guidance unit automatically generates corrections, which are passed down the wires to the missile in the form of electrical impulses. This system is much less vulnerable to gunner error than those of first-generation ATGMs. Unlike the US Dragon, the Spigot may be fired while the gunner is prone.

Spiral operates in the same way, except that a UHF radio link substitutes for guidance wires.

Countermeasures

The same basic countermeasures used against first-generation ATGMs can be used against the newer weapons, but will be less effective. The gunner is still vulnerable to suppression and distraction, as he must keep the cross-hairs on target. Their high speed makes them hard to spot in flight, there is less time to evade or dodge them, and the target need be exposed for only a short interval. The automatic guidance system prevents overcorrection and reduces the probability of error under battlefield conditions. Because corrections are generated by sensing an infra-red beacon, fires, flares and infra-red emissions can confuse the missile guidance sensors and cause it to miss.

AT-7 Saxhorn

Soviet nickname *Metis* **Warhead diameter** 100mm **Max range** 1km **Min range** 50m **Max speed** 200m/s **Weight** 6.8kg **Armour penetration** 400mm **Guidance** SACLOS wire

The AT-7 *Metis* (Mongrel), NATO code-named Saxhorn, is a manpacked ATGM. It is probably a comparatively small, light system with a 1.0km range, putting it in the same category as the US Dragon and the French ACCP, rather than a system with 2.0–3.0km range and intended to replace the remaining Saggers and supplement Spigot. It probably went into production in the late 1970s or early 1980s, and is not known to have seen combat or been exported.

AT-8 Songster

Soviet nickname *Kobra* **Warhead diameter** 125mm **Max range** 4km **Min range** 100–800m **Max speed** 500m/s **Weight** 25kg **Length** 1.2m **Armour penetration** 650mm **Guidance** UHF radio

All data approximate

The AT-8 Songster is reported to have been in service since the mid to late 1970s. It is said to be mounted on some, if not all, T-64B main battle tanks and at least some T-80s. The Soviets have experimented with mixed gun/ATGM armament on MBTs since the 1960s. T-62s had Saggers experimentally mounted over the gun barrel or in canisters on the turret. While the advantages of the long-range firepower yielded by an on-board ATGM are obvious, there are also some drawbacks, as demonstrated by comparable Western developments. Principally, it is more cost-effective to bring comparatively expensive ATGMs to the battlefield on a cheaper vehicle such as an APC or ICV.

The AT-8 is believed to be technically similar to the French ACRA prototype, and may make use of stolen technology. While some sources have suggested that it is laser designator-guided, it is more likely that it has the same UHF radio command guidance as the AT-6, using a frequency of about 8GHz,

Limitations of the AT-8 mounted on the T-64B/80 include a shortage of on-vehicle stowage, and high cost per round. Loading a missile rather than a two-piece round of ammunition into the breech of a 125mm gun in the cramped confines of a T-64B or T-80 turret must be a complicated drill indeed. The AT-8 is probably of two-piece design, the guidance and warhead unit being attached to the rocket before firing, and a boost motor carrying it clear of the gun tube at an estimated velocity of 150m/s before the main rocket cuts in. The size of the round may limit the number carried to two to four per tank. Equally problematical but less likely is external loading: unconfirmed reports have suggested that the missile is manually inserted into the muzzle and covered by canvas while travelling. The need to train tank crews in the use of an additional, long-range weapon must also be a drawback.

Combat usage and tactical employment

The AT-8 is not known to have been used in combat. Tactically, AT-8-armed tanks appeared to have inherited the role of weapons such as the ISU-122 and T-10, providing a base of long-range stand-off fire from an overwatch position. It is likely that one platoon in a tank battlion or, possibly, one battalion in a division will be equipped with AT-8-armed tanks.

The AT-8's warhead, limited to a maximum of 125mm diameter, can penetrate 650mm of rolled hardened armour; its performance against reactive or composite armour is uncertain. It may be that it is intended primarily for use against long-range ATGM-firing vehicles or helicopters.

Engagement sequence

The command transmitter for the AT-8 is housed in an unarmoured box which is mounted in front of the commander's hatch immediately before a missile is to be fired. It is not known whether the AT-8 round propels itself out of the tube when fired, or if a special 125mm round must be loaded and fired to propel the missile until its own rocket starts. The round then "gathers" the UHF radio command signals and flies to the target.

As the T-64B does not appear to have a specialised optical tracking head, it is likely that targets are acquired with the stabilised main-gun sight. Inputs from the missile – fitted with either a transponder or a tracing flare – would be automatically received and fed into a fire-control computer, generating corrections to keep the missile heading towards the target.

Countermeasures

While the usual range of ATGM countermeasures would be fairly effective against the AT-8, its high speed and lack of backblast at launch (though missile ignition will probably lead to some smoke) will make detection more difficult. Its use of a directional UHF radio link or laser would make jamming difficult.

Drakon

Max range 6,000m **Min range** 100m **Warhead diameter** 130mm **Penetration** 600mm

Reported to be a long-range ATGM for the IT-1 and IT-2 versions of the T-62 and T-72, *Drakon* may have been intended to give these tanks the long-range, stand-off firepower that had previously been provided by the obsolescent T-10 and JSU. It is not known how *Drakon* is launched. It did not achieve widespread service, and had probably been superseded by the AT-8 by the mid-1980s.

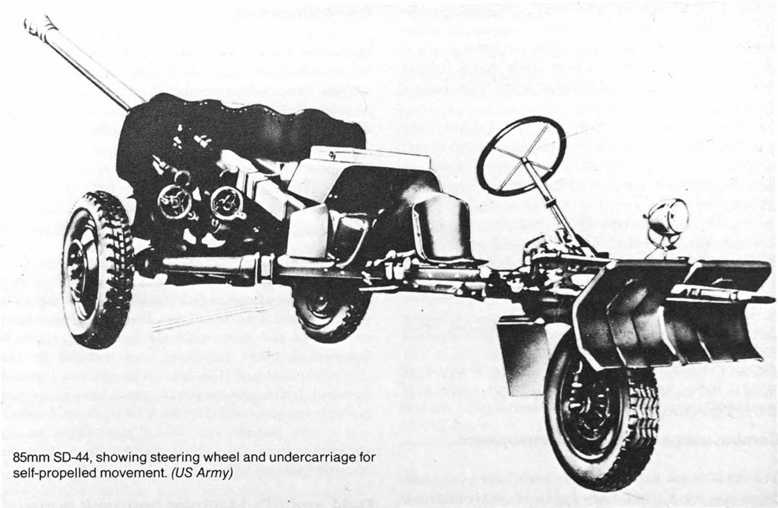
It is also possible that *Drakon* may simply be an alternative name for a better known design such as Swatter, Spandrel or Songster.

D-44 and SD-44 85mm anti-tank guns

Year introduced 1953 (1954) **Calibre** 52cal **Weight (firing)** 1,725kg (2,250) **Length (travelling)** 8.34m (8.22) **Width** 1.78m **Track** 1.43m **Elevation** −7°/+35° **Traverse** 54° **Sights** Telescopic **Night sight** APN-2 **Rate of fire** 15rpm maximum (10) **Max HE range** 15,650m **Effective APHE range** 950m **Effective HVAP range** 1,150m **Ammunition types** BR-365P, BR-367P HVAP, BR-367 APC-T, BR-365 APHE, BK-2M HEAT, O-365K HE, smoke **Muzzle velocity** 800m/sec (HE, see table for APHE, HVAP) **Shell weight** 9.54kg (HE, see table for APHE, HVAP) **Armour penetration** see table **Crew** 7 (5) **Unit of fire** 140 rounds

Figures in parentheses for SD-44 where they differ from D-44. Ballistic projectile error is 0.2m both vertically and in deflection at 1,000m using HVAP-T ammunition, and projectile error range is 37m at 10,500m and 51m at 14,085m using HE ammunition.

The 85mm SD-44 remains in service with at least some airborne regimental anti-tank companies, in a similar way to the D-44 anti-tank gun, the anti-aircraft KS-12/12A, and the gun mounted in the ASU-85. Although it is a pre-war design, it uses improved ammunition. A semi-automatic vertical sliding-wedge breech block is used. The recoil system has a hydraulic buffer and a hydropneumatic recuperator behind a steeply raked, wavy-topped shield. A double-baffle muzzle brake and split tubular trails are also recognition features.



85mm SD-44, showing steering wheel and undercarriage for self-propelled movement. *(US Army)*

The SD-44 version is unique, as it has the ability to move itself over limited distances. A 14HP, two-cylinder M-72 petrol engine is mounted on the left trail, and an ammunition box is mounted on the right trail. Petrol is carried in the hollow tubular trails. A castoring wheel with a conventional steering wheel attached joins the two trails together, the driver sitting behind the engine, and the SD-44 is ready to travel in the opposite direction to that in which the muzzle points. It can travel at 25km/h on roads and 8–10km/h cross-country, and can climb a 25° slope. Its range is believed to be limited, however. The rest of the crew is carried on the breech or trails while moving. When in action or being towed, the third wheel and steering wheel are folded and stowed between the trail legs, and the two-part folded rammer, attached to the front of the gunshield, is removed. The SD-44 retains the ability to be towed, which is its normal mode of transportation.

The self-propulsion equipment weighs an extra 525kg, and its reduced crew and the bulk of the engine cut the rate of fire from 15 to 10 rounds per minute. The 85mm is inadequate against modern tanks, but with its HE round it is still useful as a short-range field gun (the standard North Vietnamese usage).

The BK-2M fin-stabilised HEAT round was introduced in 1969, and was the first 85mm HEAT round used by the Soviets. A complete round weighs 13.35kg and the projectile weighs 7.35kg. Armour penetration is unknown, but is probably similar to the 400mm penetration ability of the 73mm PG-9 round.

The standard 85mm HE round is the O-365K with a muzzle velocity of 800m/sec and weight of 9.54kg.

China and Czechoslovakia have developed their own improved HE and APHE rounds for the 85mm gun.

The SD-44 has probably never seen action. The D-44

Performance (85mm HVAP ammunition)

Round	Type	Weight (kg)	Muzzle velocity (m/sec)	Armour penetration and velocity (m/sec)		
				500m	1,000m	1,500m
BR-365P	HVAP	4.99	1,050	139mm (895)	108mm (751)	83mm (623)
BR-367	APC-T	9.20	805	135mm (750)	122mm (697)	109mm (646)
BR-367P	HVAP	5.35	1,020	213mm (909)	178mm (803)	148mm (705)

Performance (85mm APHE ammunition)

Round	Weight (kg)	Muzzle velocity (m/sec)	Armour penetration				
			500m	1,000m	1,500m	2,000m	2,500m
BR-365	9.2	792	111mm	102mm	93mm	85mm	78mm

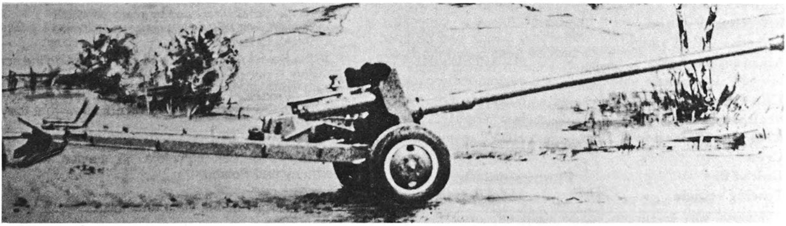
saw extensive service in South-east Asia, where the North Vietnamese used it mainly as a light field gun, and the Middle East, where it was used primarily as an anti-tank weapon, especially in the 1967 war. Chinese 85mm guns inflicted heavy losses on an attacking Soviet motorised rifle battalion in the Amur River fighting in 1969. The D-44 was replaced as a regimental anti-tank gun by recoilless guns and ATGMs, and as a divisional anti-tank gun by 100mm weapons and the improved D-48 85mm anti-tank gun. However, as late as 1979 some divisions still used 85mm guns as divisional anti-tank artillery and may continue to do so (such weapons could however now be D-48s). One low-readiness artillery division in the early 1970s had two regiments of D-44s. The Christian militia in Southern Lebanon uses D-44s supplied by the Israelis. These weapons were originally captured in the Middle East wars.

D-48 85mm anti-tank gun

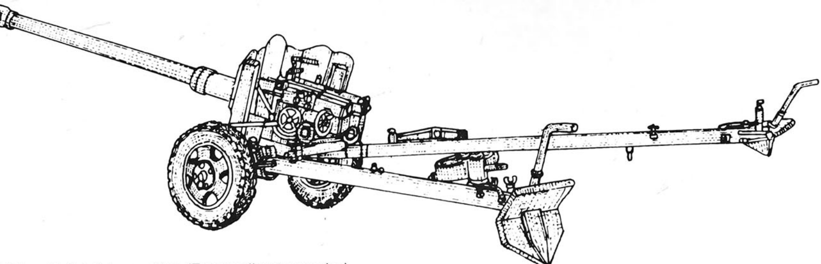
Year introduced 1955 **Calibre** 74 **Weight** 2,350kg **Length (travelling)** 8.717m **Width** 1.585m **Track** 1.2m **Elevation** −6°/+35° **Traverse** 54° **Sights** Telescopic **Ammunition** As D-44, plus additional rounds **Effective HVAP range** 1,200m **Max HE range** 18,970m **Rate of fire** 15rpm maximum, 8rpm normal **Crew** 6 **Unit of fire** 150 rounds

The D-48 is believed to have greater accuracy than the D-44.

First paraded on May Day 1955 and long misidentified in the West as the M-1955 100mm anti-tank gun, the D-48 was a product of the Petrov design bureau and was intended to serve as a replacement for the 100mm BS-3 until the T-12 was available. It is likely to remain in Soviet



Above: D-48 85mm AT gun. *(Jane's Armour and Artillery)*



85mm D-44 in firing position. (*Truppendienst* magazine)

service, possibly in the divisional anti-tank battalions of lower-readiness divisions and in mobilisation-only anti-tank and artillery formations.

The D-48 has a long, rifled barrel of monobloc construction. The recoil system is positioned over the breech, which is clamped between the twin box-section split trails when travelling. Other features include a multi-perforated muzzle brake, a swept-wing gunshield, and a vertical sliding-wedge semi-automatic breech.

The D-48 can use every current type of Soviet 85mm ammunition, including the high-performance round also fired by the D-70 85mm gun of the ASU-85. Described as a 100mm round necked down to 85mm, the latter is reported to weigh 9.3kg and to have a muzzle velocity of 1,040–1,200m/sec. It may have been a development of the BR-365/367 line.

The D-48 has been exported (but not to the Middle East) and may have seen action.

100mm anti-tank guns

	T-12 (T-12A or MT-12)	BS-3 M-1944
Calibre	66.4 (69.3)	56
Weight (firing)	2,800kg (3,100)	3,460kg
Length (travelling)	9.162m (9.64)	9.37m
Width	1.7m (2.31)	1.5m
Track	1.585m	1.8m
Elevation	−7°/+21°	−5°/+45°
Traverse	54°	58°
Sights	Telescopic	Telescopic
Nightsight	APN-5	None
Rate of fire	14rpm	8–10rpm
Sustained rate of fire	6rpm	1.55rpm
Indirect range	8,200m	21,000m
Effective AP range	1,880m	1,080m
Effective HEAT range	1,200m	900m
Ammunition types	HVAPFSDS, HEAT-FS, HE-FS	As D-10 tank gun
HVAPFSDS muzzle velocity	1,500m/sec	As D-10
HEAT muzzle velocity	990m/sec (FS)	As D-10
Shell weights (projectile)	HE 17kg, HEAT 9.5kg, HVAPFSDS 5.5kg	As D-10
Armour penetration @ 1km	HEAT 400mm, HVAPFSDS 225mm	As D-10
Crew	6	6
Unit of fire	60 rounds	60 rounds
Towing vehicle	MT-LB, G-T, AT-P, Ural-375D	As T-12

Figures in parentheses are for the T-12A where it differs from the T-12. M-1944 ballistic projectile error in direct fire is 0.15m in vertical and deflection planes at 1,000m using HEAT, and in indirect fire PER is 52m at 14,500m and 85m at 18,900m using HE.

T-12A 100mm smooth-bore, showing angled gunshield and pepperpot muzzle brake. *(US Army)*

Although the all-T-12 battalion organisation of the 1970s has been replaced with a mix of T-12s or MT-12s (the MT-12's NATO designation is T-12A) and Spandrel-armed BRDMs, reports of the development of a new 125mm weapon suggest that the Soviets still regard the towed AT gun as a valid weapon. The T-12 is used in motorised rifle divisions and independent anti-tank regiments or brigades that can be used as army or front anti-tank reserves.

Introduced in 1965, the T-12 has replaced many of the earlier BS-3 M-1944 100mm rifled anti-tank and field guns, although some remain, especially in low-readiness formations. In most divisions the BS-3 had been replaced by the 85mm D-48 as an interim measure. Predecessor to the T-12/T-12A (MT-12) series was the anti-tank version of the U-5TS 115mm smoothbore tank gun, the U5 *Rapira* 2, which was reported to have been introduced in the mid to late 1950s. It was not produced in large numbers and may not have entered service.

The T-12 is a smooth-bore, similar to the U-5TS 115mm tank gun, and is unlike any other Soviet 100mm gun, including that on the T-54/55 tank. It fires fin-stabilised, one-piece, non-rotating HVAPFSDS, HE-FS and HEAT rounds. The use of advanced HVAPDS-T and HEAT-FS rounds by rifled 100mm towed artillery is unconfirmed, these ammunition types normally being used only by tanks.

Externally the T-12 is a standard Soviet artillery design, mounted on a two-wheeled, split-trail carriage, with a long, thin gun tube ending in a "pepperpot" perforated muzzle brake. There are two recoil cylinders in place of the normal one, and castoring wheels at the end of the gun trails allow for rapid rotation. The T-12 uses the large, flat gunshield of the earlier 100mm guns, but the T-12A has a winged shield angled to the rear. Both guns have a monobloc tube and PG-1M panoramic, OP-4M-40 direct and 1.0–1.5km-range APN-5-40 infra-red sights. The Soviets say that these guns can be put into action, from travelling, within a minute. The HE indirect-fire range can be increased to 18km by increasing gun elevation to 45°. These weapons can supposedly be towed at speeds up to 70km/h.

Combat usage

The M-1944 was the biggest towed anti-tank gun in the Second World War, and was used in Vietnam and the 1967 and 1973 Middle East wars. The Indian Army made extensive use of M-1944s alongside 25-pounders as standard divisional field and anti-tank guns in 1971. The T-12 and T-12A have never seen action, except in Afghanistan, although their combat use has been limited.

With its high-velocity ammunition, the T-12 is more accurate than any other 100mm gun, though not as accurate as the U-5TS at ranges over 1,500m. It is estimated that while rifled 100mm guns could achieve a 50% hit probability against a tank-sized target at about 1,000m, the T-12, firing HVAPFSDS, could achieve the same accuracy at about 1,500m. If an HVAPFSDS round hits a tank, it would have approximately a 50% chance of knocking it out. Their high muzzle velocity gives these rounds excellent armour penetration but makes it difficult for the gunner to follow the flight of the shells and correct his aim. The MT-12 has improved firing stability, and a special set of skis can be fitted for snow or marsh conditions; the gun can be fired from the skis.

Tactical employment

T-12s form the basis of the motorised rifle division's anti-tank reserve, which may also include field artillery, tanks, ATGMs and engineers. The 12 T-12s of the

Ex-Egyptian M-1944 100mm anti-tank gun, showing characteristic dual tyres and double-baffle muzzle brake. *(Tom Woltjer)*

divisional anti-tank battalion operate in conjunction with the Spandrel-armed BRDMs. In the advance some T-12s are with the divisional advance guard. When the division is on the defensive, the T-12s are deployed in battery and platoon positions between the first and second echelon, covering the most likely routes for advancing enemy armour. The T-12s are seldom attached down to regiment; control is retained at division and the battalion is used as a unit. They are too large, too easily spotted and too vulnerable to be deployed in the first echelon, but from their intermediate position the T-12s provide an anti-tank backstop, especially important in an NBC environment when the first echelon may be hit by a nuclear strike. Any enemy armour that penetrates the first echelon will encounter the T-12s, which will delay and channel the enemy advance, weakening and disorganising it before the defences of the second echelon are encountered and giving Soviet forces time to deploy for a counterattack. If a counterattack is launched against enemy forces attacking first-echelon strongpoints, the T-12s will support or join in the anti-tank fires of the first echelon if the range permits. Minefields are normally placed 1,500–2,000m in front of T-12 positions to force the enemy to turn their flanks to the guns, break up their advance and force them into fire pockets. Moving tanks may be engaged at ranges up to 2,500m, larger targets at up to 3,000m.

T-12 batteries are often deployed on reverse slopes, as they can be depressed to a much greater degree than Soviet tanks guns. Depending on the direction of the threat, the guns will be deployed in line, in a two-line "checkerboard" formation, in echelon or in a "U". When all-round defence is important, the guns will be in a rhomboid-shaped formation. Guns are deployed between 200 and 500m apart, often in platoon firing positions. If time permits, one to three alternative firing positions will be designated or prepared for each gun, with concealed routes for changing position.

Like field artillery units, the anti-tank battalion and its component batteries are each commanded by their command and observation post, which is normally co-located with a firing position. Each battery's reconnaissance section deploys forward of the battery position to give warning of enemy tanks.

The T-12 has an offensive role, especially in the breakthrough attack. The anti-tank battalion deploys in the Soviet forward positions under cover of darkness or an artillery barrage. During the artillery preparation they will repulse any enemy spoiling attacks, cover the deployment of the attacking units along the line of departure, and engage armoured vehicles and anti-tank weapons in the enemy defensive position. During the attack the T-12s will use their fire to prevent enemy armour threatening the flanks of advancing Soviet units and, if the attack is successful, they will cover the deployment of the division's second echelon, and then move forward themselves to consolidate the objective. If the attack fails and the Soviets are forced to adopt a hasty defence, the long-ranged T-12s will support them against enemy counterattacks.

In the pursuit, or in a meeting engagement, the Soviets position T-12s in the open and engage enemy armour at close range. In these situations the Soviets are willing to accept the loss of three of four T-12s for each tank destroyed.

Engagement sequence

The telescopic sight on the T-12 is similar to that on the T-62, so the sighting and aiming procedures are probably the same, although the T-12 lacks any automatic loading or extraction device.

Countermeasures

The usual countermeasures against anti-tank weapons are effective against the T-12: artillery fire (especially airbursts), smoke, close infantry assault, and suppressive fire.

IT-122 and IT-130 tank destroyers

Weight 30 tonnes **Length** 11m **Width** 3.27m **Height** 2.35m **Ground clearance** 0.425m **Ground pressure** 0.75kg/cm² **Engine** V-55V V-12 diesel, 580hp **Range** 500km **Max speed** 45–50km/h **Gun** D-49S 122mm **Elevation** −4°/+20° **Maximum rate of fire** 4rpm **Rangefinder** Coincidence **Ammunition** 35–45 rounds **Co-axial and anti-aircraft MGs** KPVT 14.5mm with 500 rounds **Max frontal armour** 150mm, sloped **Max side armour** 120mm

All figures apply to IT-122. IT-130 is similar, but automotively closer to T-62. Gun performance for IT-122 and IT-130 approximately as D-74 and M-46 respectively.

There were only a few of these little-known vehicles in service even at their height in the 1960s. In the 1980s they may remain in storage or form part of the mobilisation-only reinforcements for certain motorised rifle formations. Alternatively, they may have followed into retirement the earlier generation of Soviet assault guns: the SU-76, 85 and 100, and JSU-122 and 152.

The IT-122 (IT, *istrebitel tankov*, tank destroyer) emerged in the mid-1950s as a follow-on to earlier successors to the wartime SU-100, SU-100P and SU-122. Resembling the SU-100, the IT-122 combined the Petrov bureau's D-49S tank version of the D-74 field gun with a T-54 tank chassis. An optical coincidence rangefinder was mounted in the commander's cupola on the right front of the vehicle.

The IT-122's successor, the IT-130, appeared in the early 1960s. Similar in design, it combined the T-62 tank

IT-122 tank destroyer stuck in the mud.

chassis and a modified version of the M-46 field gun, the 130mm M-76T. It is possible that the M-76T was an alternative design of tank gun, possibly intended as a back-up if the 125mm smoothbore did not work. The rangefinder is believed to have been a more sophisticated artillery-style coincidence rangefinder with a long base. Probably all, and at least some, IT-130s were converted into T-62-T M-1977 armoured recovery vehicles.

The 1970s member of the family was known as *Rapira* 3. It may have been designated IT-125, as it combined the 125mm gun (believed to have the Soviet nickname *Rapira*) of the T-64 and T-72 with the chassis of a T-72 (or possibly T-62) and a long-range optical rangefinder. It is not known whether this version was ever produced or entered service.

It is not known whether any IT-130s escaped conversion to T-62-T standard. In service they were probably used in the same way as the IT-122, as too was *Rapira* 3.

All of these vehicles seem to have been low-technology, low-cost solutions to the problem of long-range anti-tank fire, the alternative being the anti-tank guided missile. The provision of long-range optical rangefinders and large-calibre guns suggests that they are intended to defeat either main battle tanks at long range or the heavy tanks of the Conqueror and M103 generation at closer range. Now that the ATGM's HEAT warhead has lost some of its effectiveness against modern main battle tanks, the Soviets may look again at the use of long-range guns.

Tactical employment

It is likely that the IT-122 was originally used in independent tank destroyer regiments and brigades, serving as part of the army or front-level mobile anti-tank reserve. It may also have served in the heavy tank regiment in motorised rifle and tank divisions. It has been reported that in the late 1960s and early 1970s the Soviets planned to use these vehicles in the motorised rifle support role; a battery would have been added to each motorised rifle regiment upon mobilisation, their crews having been trained on tanks and simulators. It may be that this is still the case, at least in those regiments that lack a battalion of 122mm SP howitzers. It is likely that Soviet reluctance to throw weapons away may mean that some IT-122s are still in service, especially in lower-readiness areas and on the Chinese border. At least some have been converted into M-1987/2 mineclearing vehicles.

Combat usage

None of these vehicles was exported or saw combat, although IT-122s were used in the 1967 *Dvina* exercises.

IT-1 and IT-2 tank destroyers

These two vehicles have apparently seen only limited service, if indeed they entered service at all, and their configuration is uncertain. It has even been suggested that IT-1 and IT-2 may not be specific vehicles at all, but rather alternative designations for the T-64B and T-80 respectively.

The IT-1 is an ATGM-armed version of the T-62, probably dating from the late 1960s or early to mid-1970s. It is said to have been armed with the *Drakon* ATGM. It has been suggested that service IT-1s had the tank turret removed and replaced by a low superstructure containing ATGMs. Other reported possibilities include the mounting of ATGMs on a gun turret, with the gun tube either present or removed. This may refer to the Songster system or to experiments with the mounting of Saggers,

BMP-style, over tank gun barrels in the 1960s. ATGMs – possibly Swatters – may also have been mounted in canisters on the rear decking similar to those used to launch mine-clearing charges. It is likely that by the mid-1980s IT-1s had been replaced by AT-8-armed T-64Bs and T-80s and converted into M-1987/1 combat engineer vehicles.

The IT-2 is similar but based on the T-72 chassis.

Tactical employment and combat usage

The IT-series vehicles are reported to be in use with independent army-level anti-tank battalions. It is unlikely that many have been produced, since it would make more sense to bring long-range ATGMs to combat in cheaper and more mobile light armoured vehicles than in expensive and more difficult to maintain tank chassis. The fact that no other army has used main battle tank chassis to carry ATGMs suggests that this is an inefficient solution. The Soviets may however consider that there are some tactical situations in which such a system would be useful.

Neither vehicle has seen combat or been exported.

New 85mm anti-tank gun

Little is known of this weapon, except that it is reported to have been under development or in production in the mid-1980s. Possibly intended as a SD-44 or SPG-9 replacement, it may use low-pressure or long-rod penetration technology.

New 125mm towed anti-tank gun

There have been reports that a 125mm towed anti-tank gun is being developed as a follow-on to current 100m weapons. Such a weapon could consist of an enlarged MT-12 using the same basic gun – the 2A46 D-81 125mm smoothbore – as the T-64/72 main battle tank. This would not however explain why it has taken so long to adapt a 1960s weapon. Alternatively, the gun may be a new design, which could explain the deployment delay.

In 1983 the DIA predicted that this gun would not enter production until 1990. Other sources believe that it went into production in the early 1980s, and is replacing T-12/T-12As one for one in divisional anti-tank battalions, starting in the western military districts.

Foreign usage

The RPG-7 is built in China as the Type 69, and it is used by almost every group that employs Soviet- or Chinese-built weapons.

The SPG-9 is used by Algeria, Angola, Bulgaria, Cuba, East Germany, Ethiopia, Hungary, India, Iraq, Libya, Mozambique, Nicaragua, Poland and Syria.

The B-10 remains in service in Poland, East Germany, Hungary and Bulgaria. The Czechs use a similar, indigenous, weapon, the T-21. The B-10 is also used by most Arab armies, North Korea and Vietnam. A lighter version, the Type 65, is built in China and exported to Pakistan and Tanzania.

The B-11 is still used by the Warsaw Pact armies (with the exception of Czechoslovakia), Arab armies, Vietnam and North Korea. The Chinese received some Soviet-built examples but never produced their own.

First-generation ATGM users include:

Snapper: Afghanistan, Bulgaria (?), China (small number supplied, apparently no longer in service), Cuba, Hungary (?), Romania, Zaïre (supplied, reportedly never operational) and Yugoslavia.

Swatter: Not exported at first. Shipments then went to, in order, the Warsaw Pact, Egypt and Syria, and Iraq and Libya.

Sagger: All Warsaw Pact armies, Afghanistan, Algeria, Amal militia, Angola, China (own production), Egypt, Ethiopia, India, Iran, Iraq, Israel, Libya, Mozambique, Nicaragua, North Korea, Peru (?), Syria, Uganda, Vietnam and Yugoslavia.

Second-generation ATGM users include:

Spigot: Warsaw Pact, Finland, Iraq, Libya, Polisario guerrillas and Syria.

Spandrel: Czechoslovakia, East Germany and Poland.

Spiral: East Germany, Poland.

Songster: Soviet-only.

The 100mm M-1944 was supplied to Vietnam, Bulgaria, China (no longer in service), Czechoslovakia, East Germany, Romania, Hungary, Poland, Egypt, Syria, Iraq, Sudan, Somalia, North Korea (still widespread), Mongolia, Yugoslavia and India. The T-12A is used by the Soviet and East German armies. Other Warsaw Pact armies use only the T-12.

The 85mm D-44 and SD-44 are used by Warsaw Pact airborne units. In China it is the Type 56, the standard anti-tank gun. Other nations using the towed version are: Albania (Chinese-built), Algeria, Egypt, Syria, and Iraq (possibly replaced in these nations), Sudan, Morocco (no longer used), Vietnam, Guinea and Cuba. D-44s are in service or reserve stocks in East Germany, Bulgaria, Hungary and Romania. The D-48 was exported to Congo, Cuba, Ethiopia, India, Mongolia, Mozambique, North Korea, Romania, Somalia, Sudan and Vietnam.

The Czechs still use recoilless rifles similar to the B-10 and B-11 but of indigenous design. They are still in service in Poland, Hungary and Bulgaria as well as in Egypt, Syria, Iraq, North Korea and Vietnam.

The US has obtained a number of Soviet-built anti-tank weapons, including many RPG-7/16/18s and Snappers and some Saggers, but no Swatters.

Chapter Eleven

Artillery

"Remember, me lad, though the Irish fight well, the Rooshian artillery's hotter'n hell."

THE KERRY RECRUIT, FOLK SONG, c. 1855

Stalin called artillery Russia's God of War, and indeed Russia has been strong in artillery since Ivan the Terrible strengthened his peasant levies with massive bombards. Some 15% of today's Soviet Army mans the guns, howitzers, rocket launchers, FROGs and guided missiles that make up the pantheon which the Soviets define as artillery. Yet men and weapons are only the most obvious components of Soviet artillery. Their deployment, organisation, command, control and communications, fire direction, target acquisition, and liaison with tank and motorised rifle units will all determine how Soviet artillery is used on a future battlefield, and what effect it will have. These elements are in turn shaped by the larger concepts of Soviet military thought, which seem particularly applicable to the guns. Fire support is unitary in Soviet operations, as it is in tactics, whether it is delivered by artillery, surface-to-surface missiles, fixed-wing aircraft or helicopters. Because artillery continues to be the most efficient way of delivering high explosives to a target, it is the mainstay of Soviet conventional fire support.

Soviet artillery thought, tactics and weapons are currently in a state of evolutionary change. The painstakingly planned massed fires preceding breakthrough attacks are now the exception rather than the rule. While not disputing the effectiveness of such barrages, the Soviets believe that there will usually be no time for mass alone to do the job, no time to stockpile the ammunition, emplace the guns and prepare the detailed barrage plans. Massed artillery is vulnerable to NATO artillery guided by sophisticated target-acquisition equipment, and to aircraft and nuclear weapons. The Soviets believe that their old approach does not meet the requirements of modern war.

The Russian artillery has since recovered from its relative eclipse in the 1950s and early 1960s, when the Soviet belief in the primacy of nuclear warfare led to masses of wartime-vintage weapons using wartime massed-fire tactics. The weapons themselves are greatly improved and include 122mm and 152mm self-propelled howitzers. Numbers have also increased: the Soviet division commander's artillery assets doubled between 1968 and 1978. The emergence of new 152mm guns, 203mm howitzers, 220mm multiple rocket launchers and 240mm mortars demonstrates the increasing Soviet emphasis on heavier artillery. Divisional artillery is also becoming heavier, with that of motorised rifle divisions in Group of Soviet Forces Germany now reported to consist exclusively of battalions of SP howitzers. Tank division artillery is said to have been increased as well. Other high-readiness divisions and those in Afghanistan have also been similarly upgunned.

The 1973 Middle East war and many studies and manoeuvres increased Soviet awareness of the importance of artillery as part of the combined-arms offensive. Priorities are basically the same as those of all Soviet firepower. Enemy nuclear weapons and their delivery systems must first be eliminated, then headquarters, communications links, and target-acquisition assets. Then come forces, starting with the most vulnerable and accessible.

Artillery is also required to suppress the anti-armour weapons that threaten to defeat the Soviet armoured spearheads. Today, in the words of Soviet officers, "the suppression of anti-tank weapons ... is the most important task of the artillery," and in conventional combat "the task of destroying anti-tank weapons falls almost completely to the artillery." This suppression, to be performed as quickly as possible, is now the primary mission of the Soviet artillery.

Soviet artillery has undergone a series of substantial changes in the mid to late 1970s, reflecting changing technology and the need for new conventional war-fighting capabilities. The emergence of a new generation of tube and rocket artillery and its associated fire-control equipment has been among the most significant improvements. Numbers have also been increasing: batteries and battalions are larger, and tank and motorised rifle regiments now have their own organic howitzer battalions and MRL batteries. By 1983, for example, artillery battalions organic to motorised rifle regiments in the

Leningrad Military District each had eight-tube SO-122 batteries, though Soviet open sources still spoke of six-gun batteries. Artillery brigades and divisions also grew.

By the late 1970s the Soviets had realised that combat effectiveness was not simply a matter of delivering metal to the target. It was understood, for instance, that a longer fire mission by fewer guns renders them more vulnerable to detection and counterbattery fire. As a result, battalions rather than batteries are now largely regarded as the basic tactical artillery unit. Battery fire missions would still be the norm in difficult terrain, however, though the more complex equipment necessary would be centralised at battalion level.

The Soviets have moved away from protracted and concentrated artillery support of an attack, by means of either a rolling barrage or one that lifts to successive pre-planned targets as the attacking force penetrates the depths of the defence. The emphasis is now on short and intense bombardments, made possible by more accurate target acquisition. Concentration of the fire of different batteries on to battalion targets, and combination of the fires of several battalions, requires the use of improved fire-control computers and communications. The Soviet maxim "Concentrate firepower, not troops" applies especially to artillery, and the newer, longer-ranged weapons introduced since the mid-1970s permit this, as do improvements to the logistical system.

By the late 1970s the Soviets had concluded that they could not provide continuous artillery support for assaults unless the attacking tanks were moving at 6–8km/h or less, making them vulnerable targets indeed. Clearly, changes were required. The rolling barrage gave way to shorter, more intense surprise "fire strikes" designed to disrupt the defence long enough for a combined-arms force, following at the minimum safety interval, to be on top of the enemy before they could react. Fire strikes are also an answer to the increased lethality of NATO counterbattery fire, achieving their effect by surprise and shock before the Soviet battalions can be targeted. Disruption, rather than destruction, was to be the artillery's part in the combined-arms offensive.

The need for continuous fire during an offensive is one reason for the Soviet use of overwhelming numbers of artillery pieces, allowing half to displace forward while the other half carries out fire missions. The changes in artillery tactics in the mid to late 1970s also called for more manoeuvre of weapons, resulting in the increasing use of SP guns. Quicker response and greater flexibility are also seen as important, as is the use of helicopters to supplement artillery.

Many of these requirements have been answered by the provision of hardware. To resolve the competing demands of responsiveness and centralisation, more weapons are provided at every level of command. Regimental-level artillery battalions and MRL batteries (which appear in formations in East Germany and possibly elsewhere) give tactical commanders substantial firepower of their own. Concentration has been served by a number of different approaches, including the integration of each division's MRL battalion under command of its artillery regiment. But the most important change has been the introduction of fire-control computers and advanced communications equipment, permitting the concentration of fire of several dispersed battalions on to a single target. At higher levels of command, the RVGK "high power" artillery brigades, introduced in the 1920s, have been given renewed significance by the availability of the latest weapons. The same is true of army-level independent MRL regiments.

Organisation and objectives

Soviet artillery organisation was developed to reconcile two conflicting requirements, those of centralisation and of responsiveness. Centralisation is required for the artillery offensive, and to prepare for the breakthrough attack. However, the mobile battle and the meeting engagement, which the Soviets believe will predominate on the modern battlefield, call for something different. Each regimental – even battalion – commander needs direct artillery support to accomplish his mission. Even in the breakthrough attack this sort of mobile, decentralised battle will predominate once the first attacking units breach the enemy defences.

The Soviets have reconciled the need to supply artillery assets to commanders at all levels with the need to concentrate this same artillery so that it can act with decisive mass and power, and they have done this in a different way from the US and British armies. The British and Americans rely on a flexible system, which can allow a single forward observer to direct all artillery within range, from company mortars to corps-level heavy guns. The forward observer does not have to relay his request through successively higher levels, but speaks directly to the artillery.

Introduced in the Second World War and refined in Korea and Vietnam, this system allows centralisation while giving each commander the artillery support he requires. US (and British) artillery can respond to calls from forward observers incredibly quickly. A US forward observer (or any officer with a radio) requesting artillery support can expect the first rounds on target in under 100sec. With batteries dedicated to the support of specific units this can be reduced to as little as 38sec, including 20sec average flight time.

The Soviets know of this system but have not adopted it themselves. They believe that its almost total reliance on radio communications will cause its collapse in the face of Soviet electronic warfare, which includes the jamming

and destruction of radio transmitters located by radio direction-finding (RDF) equipment. The electromagnetic pulse of a nuclear blast will blow out the electronics of many radios and disrupt the use of surviving radios for hours afterwards. It is difficult to use a radio wearing an NBC protective suit or gas mask. For the Soviets to adopt such a system would run counter to their emphasis on the centralisation of planning at regimental and higher levels, and would probably impose an intolerable strain in terms of numbers of forward observers, radios and technicians to support it. They have neither the tactical nor technical flexibility of the US and British system.

Soviet artillery fights as part of artillery groups (AGs). Organised for a specific operation, AGs are commanded by an artillery regiment or battalion commander from his unit headquarters. An army commander will have at his disposal any army-level artillery and any front-level artillery allocated to his army, which he then either reallocates to divisions or forms into army artillery groups (AAGs), usually of long-range field guns positioned 7–12km behind the front lines. Each division commander then repeats the process, retaining some of his artillery to form a division artillery group(s) (DAGs) (one or more usually of two to four battalions of 122mm, 130mm, 152mm and MRLs for use in general support and counterbattery missions) while usually allocating about two-thirds of his total assets to regimental artillery groups (RAGs). RAGs, deployed 500–4,000m behind the front line, use 122m and 152mm howitzers for direct support and suppression. In addition, each motorised rifle regiment retains its regimental 122mm howitzers. Artillery battalions may also be attached directly to manoeuvre battalions, although they join in RAG fire missions. RAG battalions may also be detailed to support a specific battalion. Unlike an attached battalion, it is subordinate to the RAG commander rather than the manoeuvre battalion commander.

The artillery offensive

The Soviets' ability to fight a war with or without nuclear weapons has led to an emphasis on artillery as the most significant source of conventional firepower for offensive operations. As a result, in the course of the late 1970s they made substantial improvements in both artillery tactics and weaponry. The artillery offensive suppresses enemy defences before and during an attack, and precedes manoeuvre units as they advance from one objective to another. The artillery offensive may be combined with air strikes and, if ordered, NBC weapons. Its duration and strength depend upon the time available to prepare the offensive, the type of attack being launched by the manoeuvre units, and many other factors. The recent changes in Soviet artillery are intended to make it more responsive in the mobile battle.

In the attack from the march artillery support will be severely limited, and will often be provided by battalion mortars or whatever howitzers can be used in a direct-fire role. The techniques of the artillery offensive are much more refined in support of the hasty attack, and increase in sophistication, duration and size up to the artillery offensive in conjunction with the breakthrough attack, when the Soviets will mass the fire of 80–100 guns and expend 10,000–20,000 shells per kilometre of frontage.

The essence of manoeuvring fires is that they concentrate the shell impacts, not the guns. Only in the breakthrough attack will the Soviets attempt to re-create the hub-to-hub massing of the Second World War, and then only rarely; they known what a good target such concentration of guns would make.

Reconnaissance and target acquisition must precede the artillery offensive. Artillery supporting a hasty attack will often have only the reports of patrols or troops in contact to identify targets and provide information. A breakthrough attack will be preceded by lengthy and thorough reconnaissance and systematic target acquisition. A detailed list of targets will be drawn up, the destruction of nuclear delivery systems having first priority, followed by command posts, observation posts, communication and radar centres, field and air-defence artillery units, combat units in reserve positions, combat support units, and defensive strongpoints. In the hasty attack, target identification and the allocation of guns to each target are carried out orally and on the spot, usually by the artillery regiment or battalion commander.

In the breakthrough attack the artillery offensive will be set out in detailed barrage plans prepared with the aid of extensive formulae and charts to calculate the number of shells each target will require. These plans will be drawn up by the Army's Chief of Rocket Troops and Artillery. If time does not permit, the planning takes place at division or even regiment level. Artillery headquarters at regiment and higher level are normally co-located with the corresponding tank or motorised rifle headquarters. A separate artillery radio network is used to help fit all artillery into the co-ordinated fire plans: the battalion mortars, attached artillery battalions, regimental howitzers, the RAGs, DAGs and AAGs.

Following target acquisition, the artillery offensive is divided into four phases: fire protection, preparation, fires in support of the attack, and fires through the depths of the defence. Fire protection, a recent addition, is apparently intended to suppress enemy weapons, especially long-range systems, that could break up the attack. Attacks from the march are often made with minimal artillery support, while the duration and intensity of the preparation for the hasty attack depend on the tactical situation and how quickly the artillery deployed along the Soviet line of

march can go into action. Preparation time for the hasty attack averages ten to twenty minutes while the troops form up for the attack, and includes direct fire. Normally Soviet commanders will not delay such an attack to bring up additional artillery. In a breakthrough attack, preparatory fires last 40–60min. All preparatory fire times are halved if a nuclear strike is planned. The purpose of the preparatory fires is to suppress and "soften up" enemy defences, disorganise command and control, neutralise defending artillery and fire control, and create passages through obstacles, especially by detonating minefields. False preparatory bombardments can be used to disguise the location of an attack.

The use of helicopters, fighter-bombers and surface-to-surface missiles will be integrated with artillery, as will the delivery of nuclear and chemical weapons. The way the Soviets employ all these sources of firepower has been shaped by their artillery tactics. In the breakthrough attack these fires will be planned and co-ordinated at army level, but the Soviets realise that in modern combat the commanders on the spot may have to make the crucial decisions. It takes three hours to co-ordinate a division's guns for an artillery offensive, which is why the Soviets have put greater emphasis on decentralising their artillery assets for mobile combat. However, when the planning time is available the Soviets will use all possible artillery assets, including tanks in the second echelon of attacking divisions, which will be used for indirect fire if sufficient ammuntion can be brought up and dumped for them. Even if planning time is minimal, all Soviet units will join in the preparation with direct fire upon enemy positions. Supplementing tanks and BMPs in this will be artillery, normally SO-122 SP howitzers and T-12 100mm anti-tank guns, often joined by SO-152s, D-30 122mm howitzers and other towed guns.

Preparatory fire starts with several minutes' firing at maximum rate, then reverts to a sustained rate of fire for most of the preparation, and ends with another burst of rapid fire. Only enemy batteries which have actually opened fire will be engaged, so that front-line targets can receive the full weight of the preparation.

The preparation ends, and the fires supporting the attack begin, as the tank and motorised rifle units leave the line of departure. Fires supporting the attack are both pre-planned and available on call to engage targets of opportunity, the latter often being hit by direct-fire artillery. Pre-planning of targets results from the need to combine responsiveness with centralised control and simplicity of co-ordination.

Fires can be conducted in different ways. A rolling barrage is used against defensive positions or, when specific positions are not known, fired at phase lines 400–800m apart, with intermediate lines 100–200m apart, to a total depth of 4km. A double rolling barrage is directed at two phase lines simultaneously. Creeping barrages are high-density fires on successive lines, usually intended to destroy enemy armour or strongpoints. Since the late 1970s, however, the Soviet artillery has seen the fire strike – lasting no more than three to five minutes, by forces no smaller than a battalion – as its primary tactic.

In the early 1980s the Soviets estimated that battalion-sized units would handle 55–60% of all fire missions, with just 15–20% going to batteries. They have however ensured that batteries retain the ability to fire independently. This has meant that batteries – including the mortar batteries of motorised rifle battalions – have kept their forward command observation posts.

Intense fire strikes, and the fact that artillery must be relied on to counter a wide range of battlefield weapons, puts a strain on logistical capabilities. Artillery logistics support is reported to have been reorganised on branch-spécific lines since mid-1980.

The need to provide on-call artillery support requires that those commanding the preparatory fires, which had been centralised at either army, division, or, in the hasty attack, regiment level, now pass control of the artillery assets to the attacking manoeuvre units as they are committed to the attack. As each successively larger unit is committed it assumes control of its artillery assets; as the lead battalions leave the line of departure, their attached artillery and battalion mortars pass from centralised control and revert to battalion control. Similarly, as full regiments attack, the RAGs and regimental howitzers pass to regimental control, and divisions control their DAGs once they too attack.

Decentralised Soviet artillery will respond only to its own unit. If one regiment of an attacking division is held up by heavy fighting, it can call on its RAG and attached or organic artillery, and possibly a DAG. It cannot easily call on the RAG of the adjacent attacking regiment of the same division once command has been decentralised, even if that regiment is encountering only light resistance. While procedures do exist to re-centralise command in such situations, using the artillery radio network, Soviet artillery, like the rest of the Army, apparently tends to regard unit boundaries as inviolable. Of course, all of this is not necessarily going to work as planned in action. The Soviets are aware that in a major offensive it is never possible to get more than 50–70% of the artillery available to a commander into action at the same time, and that even this proportion cannot be long maintained.

The fires supporting the attack will hit enemy front-line positions until the lead attacking tanks are 250m from them; a shorter distance would make the tanks vulnerable to the shells, and a longer distance would give the enemy time to engage the tanks at long range.

Once the lead tanks have reached the enemy position the fires supporting the attack cease, and fires through the depth of the defences begin, preceding the advance of the tank and motorised rifle units after they break through the

enemy forward positions and into the depths of the defence. This is not a "rolling barrage" but includes pre-planned shifts to targets in the rear of the enemy to suppress any defences. Average time from receipt of fire orders against a pre-planned target to rounds on the ground is 2–3min for a battalion, 4min for a RAG or MRL battery, and 5min for a DAG. Shifting fires usually takes about two minutes.

By this stage the decentralisation of artillery control in the breakthrough attack will have progressed to regimental level. The direct-fire component of the fires through the depths of the defence is provided by the accompanying artillery. These are the regimental howitzers or artillery attached to manoeuvre units that follow close behind the attacking BMPs and APCs. Other indirect-fire artillery will be held in readiness to defeat enemy counterattacks.

Rolling barrages differ from the more usual successive fire concentrations in that a more uniform distribution of targets is assumed. The phase lines for successive lifts are at correspondingly uniform intervals. When firing a rolling barrage, instead of receiving specific targets each battalion is assigned a section 600–650m wide for howitzers, 450m for field guns. Rolling barrages can also be used in defence. As with other types of fire, the supporting artillery will often be divided into two halves, one firing even-number barrages and the other firing odd-number barrages, so that as one fires the other can displace and register in. The Soviets have some doubts of the practicality of such arrangements in sustained combat, however, and see helicopters as possibly offering a more responsive source of firepower to be used against targets that appear in the depths of the enemy defence.

Soviet artillery will move forward during this stage of the artillery offensive, a maximum of a third of the batteries moving at any one time. The Soviets believe that effective suppression requires continuous, uninterrupted fire, and their towed artillery, unlike that of NATO, will often not displace after a fire mission if this would disturb the continuity of firing. Soviet SP howitzers will displace more often.

The four-part artillery offensive is a vital part of the Soviet combined-arms offensive. Their increased emphasis on mobility and manoeuvre on the battlefield places a greater onus on the artillery to provide the required firepower. Fire and movement are the two components of tactics. If the tank and motorised rifle units provide the movement, the artillery will provide the fire. "Mobile firepower" is increasingly emphasised in Soviet writings. The on-call, decentralised and often direct-fire use of artillery will be the rule in future combat, not the complete artillery offensive of the breakthrough attack. The increased mobility and reduced vulnerability of the SP howitzers have made these developments possible.

Artillery on the defensive

Soviet artillery organisation and tactics in the defensive are similar to those used in the offensive. The degree of centralisation and planning depends on the time available, and a deliberate defence will have better co-ordinated artillery support than a hasty one.

The Soviets divide defence fires into five phases. They start with long-range fires to disorganise attacking units as they make their approach march, followed by massed fires on assembly areas, artillery positions and command posts. When the attack begins, final protective fires will hit pre-arranged locations in front of Soviet first-line positions, called in by radio, wire or flare signal from the defenders. If the enemy breaks through the artillery will continue its fire, including direct anti-tank fire by guns of all sizes. The Soviet artillery has often been called upon to hold the front line, and it will do so again if necessary. They may lose guns but they will not abandon them. Finally, the artillery will support the Soviet counterattacks, directing prearranged fires against pre-registered targets whenever possible. These missions are performed in the same way as those of the artillery offensive.

The Egyptians used Soviet-style defensive fires against Israeli attacks during the opening days of the 1973 War. Although they did not inflict many casualties on the Israeli armoured forces, the Egyptians disrupted and delayed the attacks and contributed to their defeat by anti-tank weapons.

Target acquisition

All forms of Soviet reconnaissance and information-gathering can contribute to artillery target acquisition. The Soviets have realised that the increasing reach and lethality of conventional battlefield weapons demand in turn more effective target acquisition. The targets the artillery will have to strike are not only potentially more lethal than in the past, but more mobile and farther behind the front lines.

The Soviets have an interlocking and complementary network of target-acquisition systems but prefer to rely on the simplest and most direct methods whenever possible. The "Mark I eyeball" of the man aiming the gun has lost none of its importance. "Artillery reconnaissance" includes electronic intercepts, radars, artillery radio direction-finding, and sound and flash ranging. Target data will also be transmitted by aircraft and long-range and troop reconnaissance patrols. Soviet artillery HQs are co-located with tank and motorised rifle unit HQs to allow sharing of reconnaissance information. Each artillery regiment has a target-acquisition battery with radar, sound and flash ranging, and radio direction-finding equipment.

Normally positioned near artillery HQs, Soviet artillery

radars, including Big Fred and Small Fred, which operate with SP howitzers, can detect enemy artillery firing up to ten kilometres behind the front lines. Soviet artillery radars lack the first-round acquisition capability of the latest NATO equipment, and are easily saturated by high volumes of fire.

DAGs, RAGs (less frequently) and battalions that are not part of artillery groups will be used for counterbattery missions. The last are co-located with direction-finding and other target-acquisition means.

Radio direction-finding equipment can locate enemy radios and direct artillery fire against them. In the 1973 War Egyptian M-46 130mm field guns, co-located with RDF units, performed effective counterbattery missions which forced the outnumbered Israeli artillery to move frequently. Israeli headquarters using their radios were also targets. Maj Gen Avraham "Albert" Mandler, commanding the 252nd Armoured Division, was killed by artillery fire in this way. The Soviet use of radio direction-finding is even more effective. Truck-mounted radio direction-finding equipment is positioned with BM-21 MRL units. The area in which a Soviet radio direction-finder can pinpoint a radio is smaller than the area covered by a BM-21 battery salvo. Once an accurate fix on the target is obtained the BM-21s will blanket the area. As radio direction-finding data can be obtained in 30sec, even mobile targets are vulnerable, as shells or rockets will be on the way 120sec after the transmission begins.

To survive the Soviet radio direction-finder threat, opposing forces must limit radio use and employ evasive techniques such as frequent movement. However, the US Army depends on its radios to a greater degree than the Soviet Army. Soviet radio direction-finding has a 99% chance of intercepting and locating within 500–700m a US AN/VRC-12 radio operating at high power with a vertical antenna, as is normally done. An AN/PRC-77 FM radio can be detected and localised within 900–1,900m 51% to 74% of the time, depending on power and antenna configuration. If the AN/VRC-12 uses low power, limiting its range, intercept probability is reduced to 75%. The use of a horizontal directional antenna, further limiting range and the direction in which messages can be sent and received, reduces intercept probability to 15% for the AN/VRC-12 and 8% for the AN/PRC-77. The effect of the radio direction-finder/BM-21 combination lies not only in the destruction caused by the rockets, but in the disruption caused to US command, control and communications by the need for countermeasures.

The simplicity of sound and flash ranging commends it to the Soviets. The standard PZK sound ranging system is an improved version of the post-war SChZ-6. The latter's ranging stations are normally positioned 1,000–1,500m apart in a straight line 2,000–4,000m behind the line of contact, and automatically wire the flash/bang times to a central ranging position, where the differences between them are used to calculate range and bearing. Sound and flash ranging can both adjust the fire of Soviet artillery and detect enemy weapons. Sound ranging is effective up to 8–15km for medium guns and 20–25km for heavy artillery, with range accurate to within 1% and bearing to within 0.4%. Flash ranging is effective at five to ten kilometres range and accuracy depends on whether theodolite, stereoscopic or stadiametric equipment is used. Sound ranging is impossible in gusty winds, and flash ranging requires the observation post to have a clear line of sight to the target. Laser rangefinders were introduced into the target-acquisition battalions of artillery divisions in the late 1970s. Their use was apparently extended to regimental target-acquisition batteries in the late 1970s. The ACRV-2 mounts a laser rangefinder. The standard dismountable laser rangefinder is designated DAK-1 by the Soviets and Sage Gloss by NATO. Battery-powered, it is about 60cm long and 30cm wide and deep, with a maximum range of 20km and a practical range about half that. According to former US Army Chief of Staff John A. Wickham, Soviet laser rangefinders pose a threat to sensors and personnel. At least one Afghan is known to have suffered eye damage after being "shot" with a laser rangefinder.

Once a target is located the artillery batteries will range in on it until it is bracketed within 100m. "Shock fire," fire without registration, is used when speed and surprise are more important than accuracy.

Command and control

Each Soviet artillery battery and battalion has a command observation post (COP) that serves simultaneously as headquarters, forward observer, and fire-direction centre. Unlike NATO battery and battalion headquarters, they do not stay with the guns but are positioned forward with the front-line troops, like the Western forward observers to which they are equivalent. This puts the artillery commander on the spot to make decisions about target acquisition, identification and engagement, and centralises command, avoids communications problems and makes the artillery more responsive to the tactical situation. It may well be that the COPs are the most important, and possibly the most vulnerable, element of the Soviet artillery system, and the best way to defeat the artillery is to defeat the COPs by destroying them, blinding them or cutting off their communications with the guns. An advantage of the use of the COP is that it allows the most experienced officer in each artillery unit to handle target acquisition and fire control. In the US Army this function is in the hands of forward observers who are often less experienced than the officers with the firing battery.

COPs are kept small, containing only the battalion

(considered the basic fire unit in the 1980s) or battery commander and his key staff. SP-artillery COPs use ACRV M-1974-2s, towed-artillery COPs BTR-60PU M-1979s. Jeeps and BRDM-2Us also remain in use. DAG command posts are often deployed in BTR-60PUs. COPs are normally co-located with the HQ of the unit being supported, and thus their distances from the front lines vary, although it is normally about 100m for a company, 500–1,000m for a battalion, 1,000–2,000m for a regiment and 2,000–4,000m for a division. If the COP dismounts, its position will be kept as small and inconspicuous as possible, making use of abandoned positions, trenches, foxholes and craters. Whenever possible, the Soviets will dig a COP position identical to the one in the diagram, although the location of the personnel varies. COPs are positioned with a good view of enemy positions; well-camouflaged dummy COPs will be set up if necessary. If the COP cannot see a target, an advance or lateral COP may be established. Called forward observation posts (FOPs) or lateral observation posts (LOPs), these are frequently used in the offensive, especially when the defence has been penetrated, and are located with forward troop elements. Battalion and battery FOPs are usually manned by the headquarters platoon leader, a scout and a radioman. FOPs have been used in Afghanistan with reconnaissance patrols, working their way close to Resistance targets to direct fire.

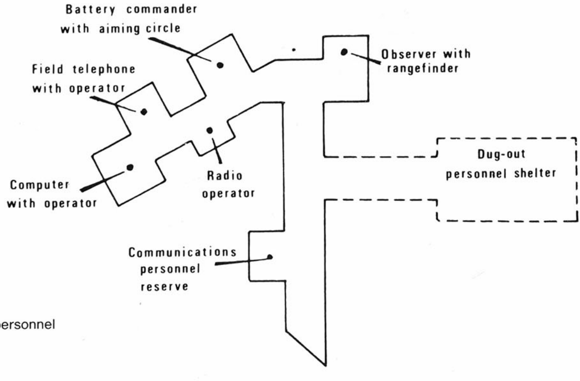
Before a battery displaces, an artillery reconnaissance group is sent to select and prepare firing positions and report on the approach routes. The personnel usually include the reconnaissance squad (of battery headquarters) commander, an operator-surveyor, two radiomen, a driver/mechanic for the vehicle used by the reconnaissance party, and the senior battery ammunition truck driver, all commanded by an officer. A similar party can also be used for topographic reconnaissance. Fire direction centres are often mounted in box-body GAZ-66 trucks in towed artillery batteries, in tracked vehicles (ACRV-2 or MT-LB) in SP batteries. They can also be static positions. But whether static or mobile, they are normally positioned with the guns. The more sophisticated battalion-level computers, mounted in ACRV-2s, ZIL-131 vans or BTR-60 M-1979s, calculate fire orders which are transmitted by data link to subordinate batteries.

Battalion and battery tactics

In the late 1970s the battalion emerged as the basic Soviet artillery tactical unit, as nothing less than a battalion (*divizion* in Russian) will have an impact on the modern battlefield. Targets are now in general too hard, too dispersed and too mobile to be neutralised by fire strikes by units smaller than a battalion. Battery fire missions are however still more common on the defence or for special-purpose or heavy tasks. Although batteries are being changed to eight guns, the original six-gun, two-platoon batteries still remain widespread. Eight-gun batteries are likely to be split into two four-gun sections, deployed separately and staggered. As the battery commander is normally away from the firing position in the COP, the battery's most senior lieutenant is in charge of the gun position, assisted by the two platoon commanders.

Battalion command must approve all battery positions. When possible, batteries will be placed on reverse slopes or in woods, with their trucks and towing vehicles under cover nearby. However, the Soviets are willing to deploy

COMMAND OBSERVATION POST



Note: Position of individual personnel may vary with the situation.

122mm D-30 firing battery in traditional but highly vulnerable linear deployment in open terrain. Tactics include the firing of illumination rounds in daylight to confuse the infra-red trackers of ATGMs. *(Marine Corps Gazette)*

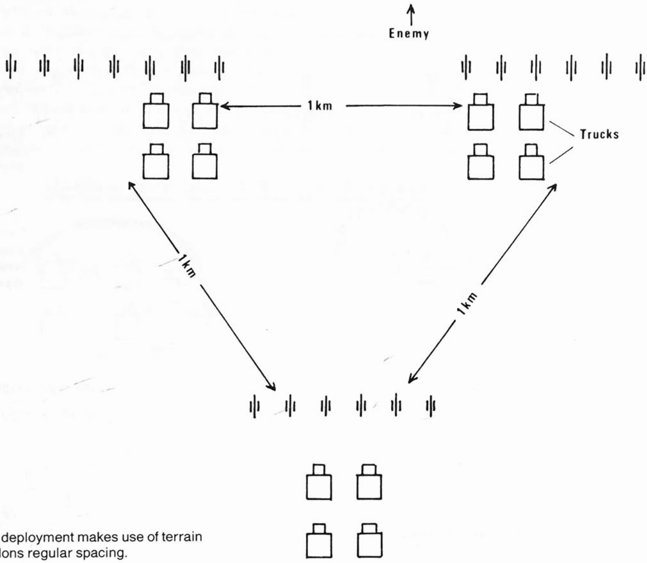
batteries in the open, without cover, if the situation requires it. Indeed, ever since Borodino, Soviet artillery has usually deployed in a linear formation without depth and without taking advantage of terrain, each battery occupying a 200m frontage. Because hub-to-hub deployment proved successful in the Second World War, and because of limited peacetime tactical training, the linear deployment endured almost as dogma until the 1970s, when it came under intense criticism as being unsuited to modern conditions. Other geometric formations used included the "U" or "V" arrangement, intended to provide rapid shifts of direct or indirect fire. Alternatively, if tank penetrations are expected, a battery may site two guns in anti-tank ambush positions while the other four continue their missions.

Since the mid-1970s the Soviets have moved away from the traditional deployments of artillery forces – batteries in line, battalions in line or triangle – as improved communications and fire-control systems have made it possible to concentrate fires from dispersed units. SP howitzer units, relying on mobility and rapid displacement to reduce vulnerability, are more likely to use the old formations. At battery level, the guns are dispersed in an area approximately 600 by 300m, making best use of terrain. Alternative firing positions are prepared, as are dummy positions when time permits.

Battalions will normally be deployed according to terrain, with three batteries either in line or in a wedge or triangle. While the battalion deploy, an alternative firing position will be scouted should rapid displacement be ordered. Temporary fire positions may be designated along the routes of longer displacements. SP artillery can displace more frequently while maintaining constant fire. Each mount will have a designated alternative position 30–400m away. Because of the difficulty of making corrections for such individual displacements, computers must be used to calculate the offset points.

A battalion may displace by leap-frogging batteries or, if there are enough of them, whole battalions may move in turn. A typical displacement distance is 3,000–4,000m. A towed howitzer battery should take about 30min by day, 40min at night from the order to move to being ready at a

TYPICAL ARTILLERY BATTALION DEPLOYMENT



Note: This deployment makes use of terrain and abandons regular spacing.

new position. The norms for reaction times in response to the traditional command for a fire mission – *za boyu* (to battle!) – are 1–1.5min for mortar batteries, 2–3min for artillery battalions, 4min for RAGs and 5min for DAGs, 2min is allowed for shifting targets. Experience suggests that these figures may frequently not be achieved in action.

Weapons effectiveness

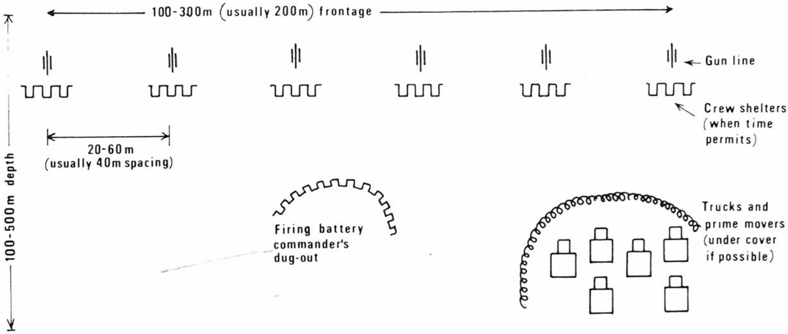
Throughout the 20th century artillery has caused the majority of battle casualties. In pure weight of metal and explosives artillery greatly exceeds all the tanks, machine guns and other direct-fire weapons, if only because it is easier to supply a ton of ammunition to an artillery battery than to a motorised rifle company. Soviet artillery will undoubtedly be of crucial importance in any future conflict.

The Soviet perception of war as a science is especially evident in their artillery tactics. The Soviets have developed and perfected their systems of artillery combat since the Second World War, and they believe that to be successful a commander need simply achieve a degree of competence in his unit that allows it to follow these systems and procedures. In reality this approach often has the effect of compelling a commander to choose to act according to either the "scientific" guidelines or the actual tactical situation. Of course, at low levels of command Soviet officers are not trained for any other type of action, a situation which does not create the initiative that the Soviet military press seems to value so highly.

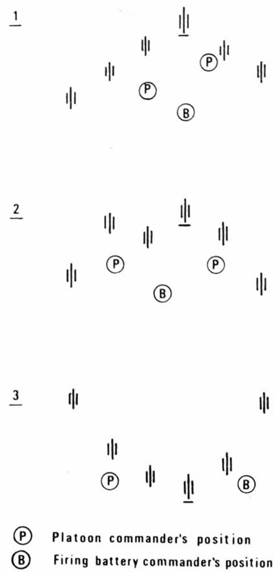
The computers increasingly available to the Soviet artillery (at least one per division in the early 1980s, probably one per battalion in the mid-1980s) are used both to direct fire – taking into account meteorological data and deviation between guns, the offset of non-linear-deployed guns from the battery CP, and other factors – and to calculate its effectiveness.

The Soviets consider the most "complex and creative" element of artillery tactics to be the determination of how many rounds are to be fired at each target. To determine this they have developed a series of projectile expenditure rates (PERs), which are based on the assumption that, of a given number of rounds fired, a certain number will

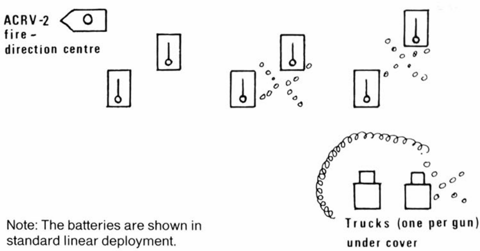
STANDARD LINEAR BATTERY DEPLOYMENT



THREE VARIATIONS ON LINEAR DEPLOYMENT



BATTERY DEPLOYMENT FOR SP GUNS



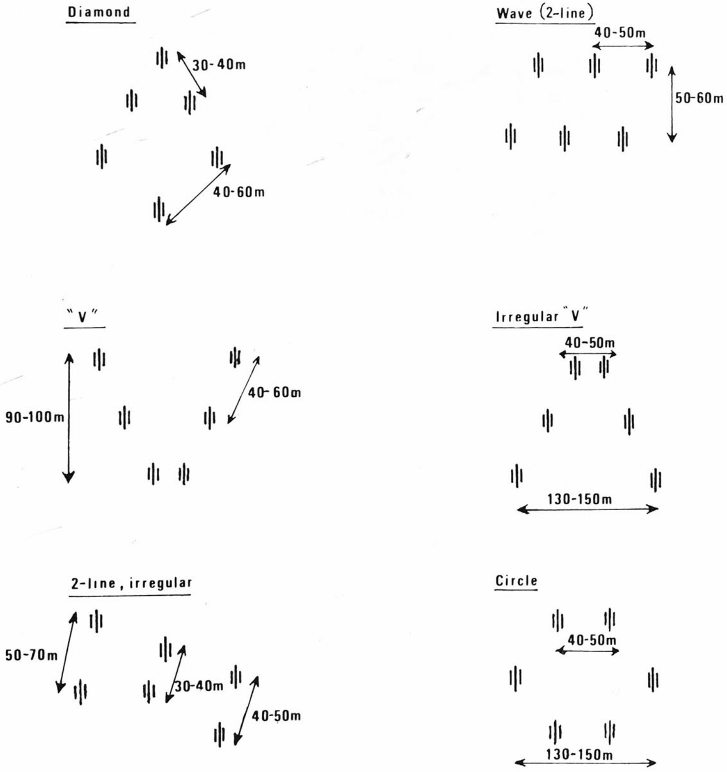
Note: The batteries are shown in standard linear deployment.

Right: **1** Battery frontage 200m, battery depth 110m, spacing between guns 40m, depth between guns 30m. **2** Battery frontage 200m, battery depth 100m, spacing between guns 40m, depth between guns 30–50m. **3** Battery frontage 200m, battery depth 110m, spacing between guns 40–50m, depth between guns 40–50m maxiumum. Note: Underlined guns are base pieces, used for registration and alignment.

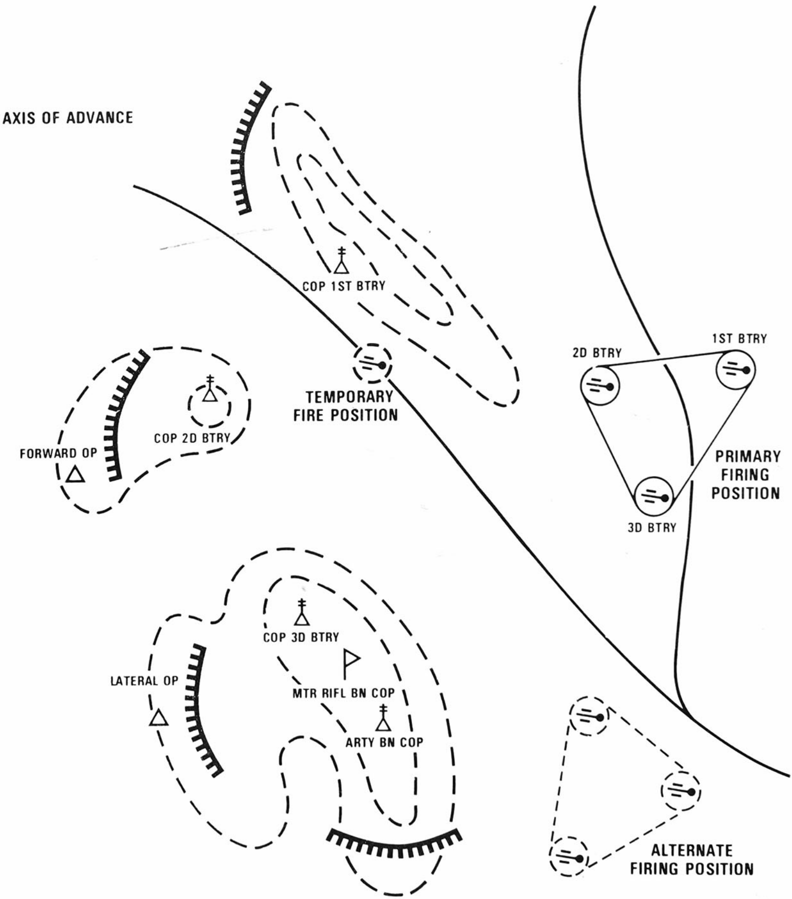
impact within the target area and will have a predictable effect – a level of destruction – expressed as a percentage of damage inflicted. Harassing fire requires a 10% level of destruction to be effective. To neutralise and suppress a target is assumed to require a 20–30% level of destruction, and this is the normal goal of Soviet artillery. To destroy a target requires at least a 50–60%, often a 70–85%, level of destruction. All of these assumptions are the result of wartime experience and years of study and tests by the Soviet artillery. Yet the nice, neat charts of PER and weapons effectiveness (not only those put out by the Soviets) appear similar to those prepared before the First World War and which proved to be completely invalid when put to the test of combat. For all the Soviet reliance on performance and armament norms to maintain their command control, it is impossible to say that any view of Soviet artillery effectiveness is correct or accurate. It is only possible to say that these views reflect how the Soviet Army believes its artillery will function in combat.

The table on page 235 expresses percentages of

STANDARD ALTERNATIVES TO LINEAR DEPLOYMENT

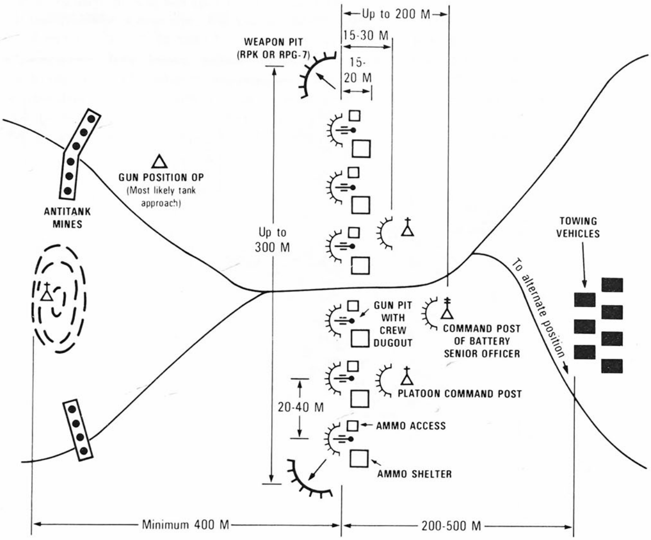


ARTILLERY BATTALION COMBAT FORMATION



Note Batteries are normally 500–1,500m apart within the battalion firing position.

TYPICAL TOWED GUN BATTERY POSITION



Note Slit trenches and crew shelters may be dug beside gun pits and command posts. Positions may be linked by communication trenches. *(US Army)*

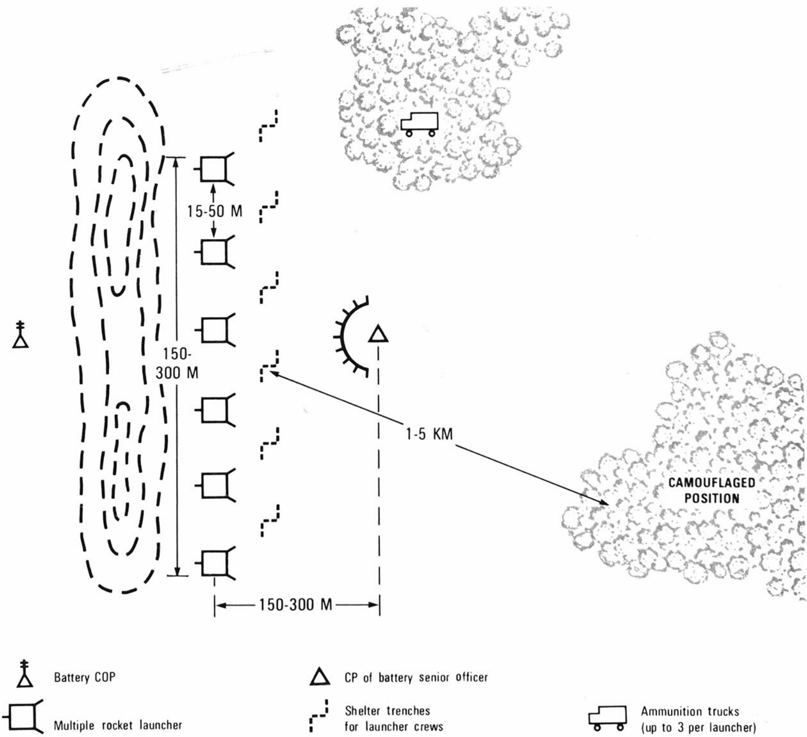
Soviet artillery effectiveness (US Army estimate)

Artillery piece	Number of shells	Target type and posture					
		US tank bn		"Chinese" tank bn		Infantry bn (any nation)	
		Attack	Defence	Attack	Defence	Attack	Defence
152mm howitzer	30	3	0	5	1	8	3
	60	4	1	8	2	14	5
	90	5	2	10	3	19	7
	120	6	2	12	4	24	8
	150	7	3	15	5	27	10
	180	8	3	17	5	31	12
122mm or 152mm gun-howitzer or 130mm gun	30	2	1	3	4	7	4
	60	3	2	5	5	12	5
	90	4	3	7	6	17	6
	120	5	4	9	8	22	8
	150	6	5	11	9	26	9
	180	7	5	13	10	29	12
BM-21	32	3	1	6	1	10	4
	64	5	2	9	2	18	6

casualties that would be suffered in a 1,000m-sq attack area by the type of unit indicated, either on the attack or in defence. "Chinese" tank battalions are any that are identical to Soviet tank battalions. The higher effectiveness of the howitzer is due to the plunging trajectory of its shell and the resultant fragment distribution. The table does not reflect the greater accuracy of field guns, but it does show the ability of the BM-21 to deliver its projectiles as a single salvo. The table is used in US Army Command Post Exercises (CPX) to assess artillery fire effectiveness.

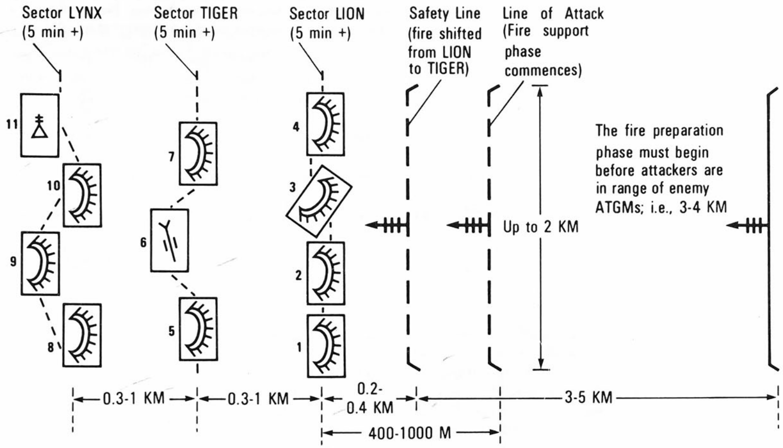
To determine the number of 122mm howitzer rounds required to achieve any required level of destruction at a range of 12km or less, a Soviet commander will use the following norms:
Firing at **troops under cover and weapons in prepared strongpoints** ; number of shells required per hectare of target area: 47 rounds using "shock fire" with no preparatory adjustments, 35 rounds if using fire adjustment or shifting fires. VT fuzes would not be used against such targets.

BM-21 ROCKET LAUNCHER BATTERY DEPLOYMENT



Notes: 1 After firing, rocket launchers return to camouflaged position or move to a new fire area. **2** In the defence, each BM-21 might be emplaced in a firing position, and landline would be laid. **3** Launchers can be fired remotely from crew shelter trenches, using 60m cable.

SUCCESSIVE FIRE CONCENTRATIONS



Following preparatory fire on all targets (average size 200m × 300m), the fire-support phase begins with up to one artillery battalion engaging each target in the first sector. *(US Army)*

Firing at **troops under cover and weapons and APCs in a hasty strongpoint** ; number of shells required per hectare of target area: 35 rounds using shock fire (reduced to 17 rounds if using VT-fuzed rounds), and 26 rounds if using fire adjustment (13 rounds if using VT fuzes in the shells).

Firing at **openly deployed ATGMs and anti-tank guns and other individual targets** ; number of shells required per target: 33 rounds contact-fuzed or 16 rounds VT-fuzed for shock fire, and 25 rounds contact-fuzed or 12 rounds VT-fuzed for adjusted fire.

Having determined the basic number of shells required, the Soviet commander then multiplies it by two numbers: first, the number of hectares (10,000m^2) of target area or the number of targets; second, one of the factors in the table below, depending on the level of destruction required in the target area.

These calculations not only show the anticipated performance of Soviet D-30 howitzers on the battlefield, but also reveal many of the requirements and restraints of artillery tactics. The type of fire used is important. Accuracy is reduced when "shock fire" is used, but if fire is adjusted until the target is bracketed the element of surprise is reduced. In surprise fire the first volley is always the most effective. The type of fuze used is also important. Soviet howitzers did not use VT fuzes until comparatively recently, in contrast to the US and British artillery, which adopted them in 1944. These proximity fuzes are triggered by radar impulses to detonate at a pre-set altitude, and are effective at showering fragments down on troops in foxholes. The number of shells required for the higher levels of destruction, regardless of the type of firing or fuzes, increases exponentially. The Soviets normally consider a 20–30% level of destruction adequate for suppression. A 70% level of destruction is normally considered adequate for destruction, but this requires such large shell expenditures that this effect is normally reserved for weapons with nuclear capability. A 50–60% level is considered acceptable for the destruction of enemy artillery; 10% is for harassment.

The expenditure rates in the table overleaf are based on a target battery frontage of 150m wide by 100m deep.

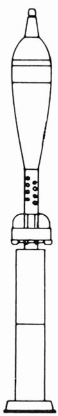
Level of destruction	10%	15%	20%	25%	30%	40%	50%	60%	70%	80%	90%
Multiplier	1.00	1.67	2.43	3.28	4.27	6.67	9.48	14.38	21.1	31.65	53.57

Projectile expenditure rates for counterbattery fire

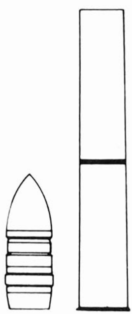
Target	100mm BS-3	122mm D-74	130mm M-46	122mm D-30	152mm D-1	152mm D-20	120mm mortar	160mm mortar	240mm mortar	122mm BM-21	240mm BM-24
Battery, towed guns	240	220	200	220	180	180	200	120	100	400	170
Platoon, towed mortars	180	165	150	165	135	135	150	90	70	300	130
Battery, armoured SP guns	300	270	260	380	300	285	300	290	175	440	210
Battery, unarmoured SP guns	265	240	230	310	260	240	250	240	130	330	170
Platoon, unarmoured SP guns	230	200	200	270	220	205	210	200	115	350	150
Platoon, SP mortars	360	320	310	430	330	310	320	300	170	540	230
Destruction of a launcher	320	260	240	260	200	200	–	140	110	270	200
Neutralisation of a launcher (rpm)	10	8	7	8	6	6	–	6	5	7	6

Larger targets will receive proportionally more rounds: a battery with a 200m frontage would receive 10% more rounds, other considerations being unchanged. If only one or two guns have been located, the frontage of the battery is assumed to be 200m to compensate for target location errors. When the fire is shifted from a registration point and adjusted on target, PER is reduced by 25%. For non-armoured SP gun targets PER is increased by 130%, and by 150% for armoured SP guns. For each kilometre of range over ten, the PER is increased 20% against towed artillery and 40% against SP artillery.

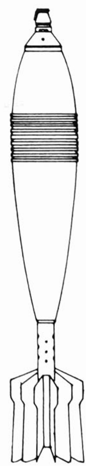
Normally only nuclear-capable launchers are destroyed, as shown in the table. However, to achieve destruction against artillery targets at least 200–300% of the PER against batteries in the open and 300–400% against dug-in guns will be required. 5% is added to each PER for



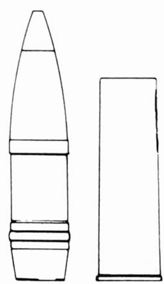
107mm Recoilless
B-11



122mm
Field, Tank
AP

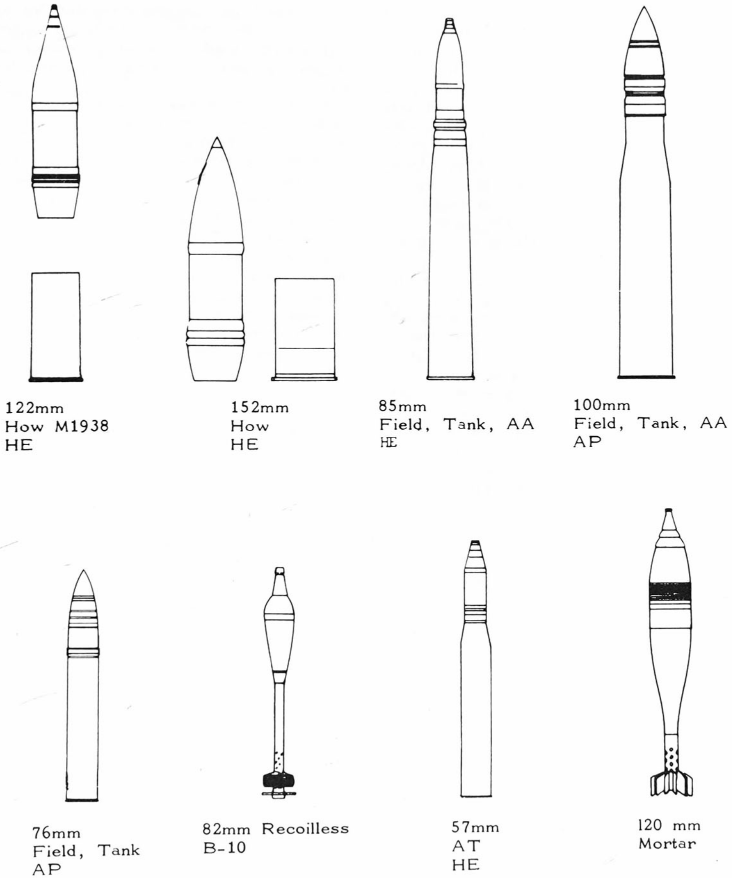


160mm
Mortar



152mm
Gun How
HE

ranging-in purposes. These PERs assume a range of approximately ten kilometres, and also assume that the shells will come from three batteries firing for effect. If the range is less than ten kilometres, the PER is reduced. If the target is at eight to ten kilometres range the PER is reduced to 78% of that listed, and if the target is at six to eight kilometres range the PER is reduced to about 65% of that listed (individual types of gun may be reduced to 62–66% but most use 65%). The PER for MRLs will not change appreciably with range.



Comparative sizes of selected Soviet artillery ammunition. 122mm gun ammunition is for the A-19 field gun. Scale is 1 : 10. *(US Army)*

A key variable is the type of sub-unit used to deliver the projectiles. At present most Soviet planning envisages a fire strike by at least a battalion. If destruction rather than neutralisation is required, it is the number of battalions rather than the length of the fire mission that will have to be tripled.

The actual level of destruction required to achieve neutralisation of an enemy battery varies with the type of target, the type of gun firing, and the number of batteries firing at it. For D-30 122mm howitzers the level of destruction for neutralisation is 23.5% with one battery firing, 26.1% with two batteries and 28.6% with three batteries. D-20 152mm gun-howitzers achieve a 23.8% level of destruction when firing for neutralisation with one battery, increasing to 27.1% and 30% for two and three batteries respectively. M-46 130mm field guns achieve 22.8%, 25.2% and 27.8% levels of destruction with one, two and three batteries respectively. These figures reflect the greater destructive power of the howitzer shells and their pattern of fragment distribution.

The PER is also affected by the type of fuzes used in the shells. It is halved when using VT-fuzed shells against towed guns deployed in the open; the fragmentation effect will be deadly without overhead cover, and the fragmentation area of such shells is twice that of impact-fuzed ones. If the target has earth and timber overhead cover, the first shells will be impact-fuzed to blow away the cover, and the remainder will be a mix of VT and impact-fuzed shells. Armoured SP guns will receive impact-fuzed shells, for not only will a rare direct hit destroy them but a near miss may disable them, while fragments from overhead will usually not penetrate their armour. In deep snow impact-fuzed shells will often bury themselves before exploding, reducing their blast and fragmentation effects by 50%, so VT fuzes are used whenever possible. If VT fuzes are not available, the PER must be doubled. Towed guns in weapons pits will also attract a mixture of VT and impact-fuzed shells, and the PER is also increased if VT fuzes are not used.

The PERs also assume that a target will be hit by two artillery strikes at an interval of 15–20min or less. It can be longer, as the Soviets state that combat experience has shown that a neutralised enemy battery will usually remain so for 30min. They realise that SP guns are harder to neutralise, and that they may not stay neutralised as long as towed guns.

The PER varies with the type of target acquisition and fire control and correction used, and how current the fire-control solution is. If a relatively inaccurate method of rangefinding is used, such as sound without confirmation from other sources, the PER increases to a point at which the Soviets probably would not fire. But if a helicopter or an aircraft is available to correct fire, or if a target is spotted by the COP directly, then the use of ranging rounds (either smoke or HE) and adjustment of fire will increase accuracy.

The PERs recognise that mass creates effectiveness. To get the equivalent effect of one three-battalion volley (54 shells) against infantry in the open requires ten one-battalion volleys (180 shells) or 43 one-battery volleys (258 shells). Awareness of this effect has caused the Soviets to move towards shorter but massed fires as the primary means of delivering metal to the target. Larger fire strikes also minimise time of exposure to counterbattery fire.

As well as neutralising and destroying specific weapons, the Soviets also have norms for the amount of fire used in the "successive concentrations of fire" employed in support of the attack, and for fire support during the "fires through the depths of the defence" phase of the artillery offensive. Fire is delivered on specific, preplanned points to suppress enemy defences, and these target points are advanced as the troops advance. These jumps will be relatively small, as transfer of fires is normally limited to 300m in deflection and 200–1,000m in range; otherwise a new aiming point will have to be registered. The table at the top of page 241 shows the number of rounds per minute per hectare that have to be fired by various weapons to achieve effective successive concentrations.

Thus the Soviets consider that a D-30 battery would fire 12 rounds per minute (two rounds per minute per gun) to suppress a 200m^2 area.

The massing of artillery is important for effectiveness. For breakthrough attacks against a prepared defence, a minimum of 100 tubes (gun barrels) per kilometre of frontage is required, compared to 80 tubes per kilometre in an attack on a hasty defence and 40 tubes per kilometre for an attack on a minor axis of advance. These norms are achieved by using guns from army and front-level artillery units and second-echelon divisions. The assigned sectors for offensive barrage fires are 20–25m per 100mm or 130mm gun and 150m per battery and 450m per battalion equipped with these weapons. The sectors for all other tubed artillery are 35m, 200m and 600–650m respectively for individual guns, batteries and battalions. Because of the greater intensity of these fires, these sectors are smaller than for other types of fire. When an interdiction barrage is fired, seeking to block enemy movement, coverage is 50m per tube and 900m per battalion. These barrages require great ammunition expenditure and are only fired for short periods on pre-planned lines.

To achieve these firepower concentrations batteries are separated by 400–2,000m with an average of 1,000m. Individual weapons in battery positions are separated by 15–40m. These relatively tight concentrations allow for massed fires. Separations also depend on the target. For example, 110 guns per kilometre are needed to overcome a US or German division, 100 for a British division, and 90 for Belgian or Italian divisions. Also taken into account are

	100mm BS-3	122mm D-30	130mm M-46	152mm D-1 & D-20	120mm mortar	160mm mortar
Rpm per hectare covered	3	3	3	2	3	2
Hectares covered per battery	3	4	3	3–6	2	2–3

factors such as changes in the organisation and equipment of the target units.

Another measure of artillery effectiveness is the estimated number (not per cent) of losses per ton of shells fired from that weapon at defending targets:

Target	122mm D-30	152mm D-20
Dug-in infantry	3.49	1.58
Infantry in the open	34.9	15.8
SP artillery	0.03	0.01
Artillery crews (in men)	8.6	3.95
Artillery trucks	1.23	0.56
Tanks	0.10	0.04
Tons fired per hour (max)	23.1	34.0

Fatigue reduces artillery effectiveness. A D-30 crew in action for ten minutes can sustain 2.4rpm, falling to an average of 1.6rpm after 30min, 1.2rpm after 60min, 1rpm after 90min, and 0.9rpm after 120min. If the crew is wearing NBC suits or working under adverse conditions the fatigue will be worse.

Soviet artillery uses chemical ammuntion as a matter of course. Routine training includes combat under chemical conditions and using chemical shells, making the Soviet artillery competent in the use of chemical weapons once it has been decided to authorise their use. Today, as in 1917, chemical weapons are powerful in both suppression and counterbattery fires. Because chemical weapons affect a large area, targets do not have to be pinpointed, relieving the pressure on Soviet target acquisition. The chemical weapon is perhaps the most effective used by the Soviet artillery.

At night Soviet artillery is slower in responding to fire requests and target acquisition is less effective. To preserve the element of surprise there will often be no preparatory fires before a night attack. When artillery is used the provision of illumination becomes an important objective. Illumination rounds are also used in conjunction with direct-fire weapons to show the direction of an attack and to dazzle enemy troops and infra-red trackers. A star shell illuminates a circle 500–1,500m in diameter for 30sec. For continuous illumination the Soviets plan to use one gun and three star shells per square kilometre per minute. Illumination rounds are separate from standard PERs, which are also increased at night. Direct-fire artillery makes heavy use of star shells and infra-red sights.

In urban combat the Soviets will bring even towed heavy guns to within 200–300m of enemy positions to deliver devastating direct fire. Using direct fire, a single round from any Soviet gun or howitzer can penetrate a building, although structures with thick stone outer walls require five or six hits. A single round will usually create a breach, though eight rounds are needed against stone buildings, five against strong brick, and six against reinforced concrete. Weapons of 152mm and larger can do it in one round less. This is much more effective than indirect fire, which takes eight D-30 battery volleys to reduce even a wooden house to rubble, and 24 volleys to destroy one of reinforced concrete. 152mm and larger guns are more effective but they too find it difficult to level buildings with purely indirect fire.

The US Army calls the smoke shell "the thinking man's ammunition." The Soviet Army has apparently been putting increased emphasis on the use of smoke in recent years, and, as early as 1963, saw it as one of the ways in which the effectiveness of modern direct-fire weapons, especially the ATGM, can be defeated. The effectiveness of smoke is heavily dependent on wind conditions, and it is most effective when the wind is blowing at four to fourteen knots and across the smoke pattern. Soviet smoke shells include both white phosphorous (WP) and hexachloro-ethane (HC) types. Because WP explodes its smoke builds more quickly, but it does not burn for as long or cover as large an area as HC. The capabilities of different Soviet smoke shells are shown in the table below.

The areas covered represent the diameter of the area smoked-in given a favourable quartering wind. A

Weapon	Ammunition	Coverage (one round)	Coverage (battery volley)	Time to build screen	Burn time	Height of screen
120mm mortar	WP	80m	160m	30sec	60sec	50m
122mm howitzer	HC	200m	400m	60sec	180sec	50m
130mm gun	HC	200m	400m	60sec	180sec	50m

quartering wind would increase the area covered by 120–140%, while a head or tail wind would reduce it to 70–80% of its normal diameter with WP and 33% with HC. Burn time is the time the shell actually produces smoke. To maintain a constant smokescreen 122mm and 130mm weapons would fire one HC shell per minute in most conditions, increasing to two or three in adverse conditions, with 152mm weapons firing half these amounts. The Soviet use of smoke is likely to be thorough and imaginative. On the basis of exercises the Soviets have concluded that effective smokescreens can reduce the losses of attacking tank and motorised rifle units by 60–80%, and that blinding enemy direct-fire weapons can reduce casualties by 90%.

All Soviet artillery retains a direct-fire anti-tank capability, and 5% of each Soviet artillery unit of fire is anti-tank ammunition. But these weapons are only effective at short range, as shown by these US Army figures assessing the probability of a hit against a stationary vehicle:

If a hit is scored, a 122mm HEAT round has approximately a 53% chance of killing an M60 and a 93% chance of killing an M113, while a 152mm APHE round, equally approximately, has a 56% and an 83% chance of killing an M60 and M113 respectively. As any gun within 1,000m of a tank will be hit by the tank's machine guns and main armament, Soviet field guns will have to engage tanks from ambush or, more likely, as a self-defence measure. The Soviets realise that there may be no stable front line in modern war, under either nuclear or conventional conditions, and their artillery may often find itself holding the front line.

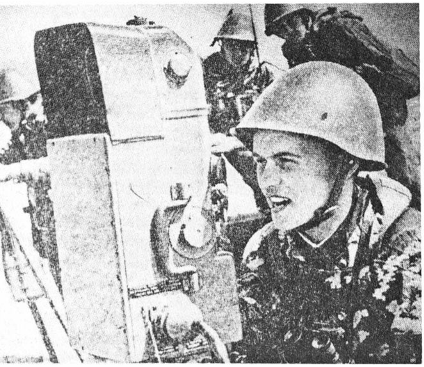
Engagement sequence

Artillery planning and targeting are performed at as high a level of command as time permits, but the Soviets believe that most artillery action will be directed at battalion or battery level in mobile combat. These artillery commanders decide how to engage targets of opportunity and those spotted by target-acquisition means and supported tanks and motorised rifle units.

Firing data at battery level are prepared by four sources: the battery commander, an officer with the guns at the firing position, the PUO-9 mechanical fire-control computer located in the COP, and the computer positioned with the guns, which the Soviets have found is usually the first to achieve a complete fire-control solution.

Weapon	Ammunition	Range (metres)					
		50	100	175	250	500	750+
122mm D-30	BK-6M HEAT	97%	94%	89%	72%	50%	31%
152mm D-20	BR-472 APHE	97%	94%	92%	75%	56%	39%

DAK-1 Sage Gloss laser rangefinder on a tripod mount. *(US Army)*



A PUO-9 can be set up complete in 5½min, and the time per target from announcement of a target location to the fire order is one minute. This is acceptable in any army, even those using more sophisticated equipment, and the PUO-9 requires only one man to operate it. The data obtained are then passed to the two firing platoons. The battery commander and the COP computer also compute fire-control data as a check on the battery computer, and the battery commander will use whichever solution he believes the most accurate. Battalion COPs are similar, but use more sophisticated fire-control equipment.

Increased use of computers will further reduce response time. The firing battery commander, assisted by the technician operating the computer, applies the latest variable to the firing data; the Soviets place great emphasis on deviations in muzzle velocity in guns. The guns are usually laid on a common grid azimuth. Each gunner elevates his piece using a range drum, simpler than the US (and British) procedure of using an elevation scale or drum. The battery is then ready to fire for effect. In observed fire this starts with firing salvos rapidly to achieve

surprise and to let the COP refine range and deflection. After this, fire continues at a sustained rate, possibly ending in a burst of rapid fire. The Soviets believe that this varying of rates of fire increases psychological effect. In unobserved fire the same pattern of rapid volleys, deliberate fire and then more rapid volleys is followed.

The Soviets follow the same sequence throughout the preparation phase of the artillery offensive. A typical preparation lasting 25min would start with massive surprise concentrations of fire throughout the depth of the defence. After five minutes the fire will shift to priority targets, and after another ten minutes it will change to fire at the sustained rate. After a further ten minutes of this, the last five minutes before the attack will be at rapid fire, repeating the intial strike.

Artillery in Afghanistan

Soviet artillery has been in action throughout the Afghanistan war. Like the Army as a whole, artillery trained and intended for conventional combat has had a difficult time adapting to counter-guerilla warfare in the terrain of Afghanistan, as has been the case with other modern armies in similar conflicts. After numerous different approaches and false starts in the opening years of the war, by 1984–85 the Soviets had apparently developed an approach to artillery use in Afghanistan that minimises their weaknesses while being consistent with their overall operational method.

Throughout the war the artillery has stayed close to conventional tactics. As the Soviets have tried to get away from the early-war model of a single roadbound mechanised force pushing inexorably forward while guerrillas wait to attack their night positions or ambush resupply convoys, they have emphasised reinforced battalion-sized forces, either inserted by a helicopter or moving in armoured vehicles on independent axes of advance (although Afghan terrain often limits the use of such forces). While there are severe limits on the artillery that heliborne forces can bring with them, the other independent forces can have the full scale. SP or towed 122mm howitzers are the most common, though BM-21 122mm MRLs and M-46 130mm field guns have also been used this way. All this adds up to a decentralisation of firepower and a move away from the rigidity that has marked much of Soviet tactics in Afghanistan. The new tactics might also be used against more conventional opponents.

In 1980–83 the artillery concentrated largely on support of the ground forces. In 1980 Soviet forces were employed in large-scale ground operations, calling for extensive preliminary bombardments. Combined-arms offensives in Afghanistan have in general been preceded by heavy barrages by tube and MRL artillery, supplementing strikes by fighter-bombers and attack helicopters, in spite of the fact that they make surprise impossible.

Battalion and regiment-sized forces in Afghanistan often go into action accompanied by a battery or, more often a battalion of artillery. Particularly since 1984, the latter have been composite units, including towed and SP howitzers, MRLs and heavy artillery. If a Soviet unit is to advance into a valley, for example, the artillery will be deployed in a base outside the valley, firing a pre-planned barrage in front of the advance. Lasting up to 20min in the case of a battalion advance, the barrage may be much longer for a major offensive.

The Panjshir VII offensive of 1984, the abortive relief of Khost in the summer of 1985, and the drive on Zhawar in early 1986 were all preceded by extensive artillery barrages co-ordinated with fixed-wing air strikes. In Panjshir VII, the latter were carried out by Fencer and Badger bombers, one of which flew into a mountain in the bad weather that hindered the offensive. Barrages like these can last three to five hours, repeated on successive days, and be extremely intense. Those of the 1985 Khost and 1986 Zhawar offensives – carried out by air and artillery combined – interdicted guerrilla movement and, although they did not inflict many casualties, kept the Resistance off the high ground and pinned down or in caves. The Panjshir VII preliminary barrage did not claim many Afghans either, for they had all pulled back into the mountains in the preceding weeks.

Preliminary bombardments, co-ordinated with air support, are also used to protect convoys, with major movements being preceded by a barrage along the route. This method does however leave a gap between the lifting of the barrage and the arrival of Soviet forces that the Afghan guerrillas can exploit. The need to keep close to the barrage is stressed, but this is not always possible. As a result, the guerrillas routinely wait until the barrage lifts before taking their positions.

The more traditional barrage-type fires seem to predominate in Afghanistan, though firestrikes have also been reported. Such strikes appear to be used most frequently against villages and areas reported to contain Resistance forces. Multiple rocket launchers are frequently used in this way. Maulavi Shafiuallah, the foremost guerrilla commander in the Koh-i-Safi area, was killed by a fire strike in the spring of 1985. Fire strikes appear to be used interchangeably with helicopter or fixed-wing air strikes, the greater responsiveness of artillery apparently having no influence on the way it is used for such tasks.

Since 1984 the Soviets have put more stress on artillery in Afghanistan, particularly the use of heavy artillery against the agricultural infrastructure and guerrilla strongholds and groups. While it was reported that the 40th Army's non-divisional artillery brigade had been withdrawn in 1980, the usefulness of heavy artillery must have been subsequently reconsidered. As a result, by

1984–5 long-range tube artillery (M-46 130mm, and 152mm field guns), 240mm SP mortars, BM-27 220mm MRLs and conventional FROG-7s were all in use. These weapons fired both HE and submunition rounds.

Throughout the war the main limitation on artillery has been the lack of effective target acquisition and intelligence. So, lacking specific targets, the artillery has been employed instead to attack villages and areas suspected of harbouring or supporting guerrillas. This can be done in reprisal for guerrilla activities – ambushes are usually followed by air or artillery attacks on nearby villages – or in support of the longer-term goal of destroying the villages from which guerrillas could mount attacks on high-value objectives such as urban centres, roads and airfields. Artillery is thus playing a major part in draining the "sea" in which the guerrilla "fish" must swim, and relentless reprisal shelling and bombing has over the years substantially inhibited Resistance activity in many areas.

Although the Soviets have by this means minimised the need for target acquisition, they have nevertheless invested significantly in the systematic gathering of intelligence and target-acquisition data. Methods include radio direction-finding (Resistance radio use is limited more by shortage of equipment than by awareness of RDF threat), human intelligence (the network of DRA secret police informers has become more widespread and effective in recent years and is the intelligence means most feared by the Resistance), fixed-wing reconnaissance aircraft (either MiG-21R Fishbeds or, more frequently, sensor-equipped Antonov An-26/30/32s), reconnaissance helicopters (usually Mi-8 Hips) and ground patrols.

A wide range of artillery-related target-acquisition equipment has been deployed in Afghanistan, including Big Fred artillery radars. Nonetheless, the guns are usually limited to pre-planned targets. Resistance mortar and rocket attacks on Soviet positions should have provoked an accurate and intense reply. But Soviet counterbattery fire is rare in Afghanistan, surprisingly so considering the emphasis in tactical literature on prompt and accurate response. Pre-1986, Resistance attacks were more likely to draw fire from helicopters than from the artillery. It is uncertain whether this results from a weakness in Soviet counterbattery capability that would cost them heavily in a conventional conflict, or from a deliberate decision prompted by the adaptation of tactics to Afghan conditions.

Similarly, before about 1984 Soviet and DRA artillery showed itself reluctant to engage Resistance targets of opportunity in the border areas, so that Resistance trucks were able to move with impunity in daylight within sight of DRA-manned observation posts. But following the increased emphasis placed on interdiction of Resistance supply lines in 1984–86, a more aggressive attitude is taken towards the engagement of such targets, although it is usually helicopters or ambush patrols rather than artillery that are used.

Before the war the DRA Army was equipped largely with Soviet weapons and its officers trained in Soviet-style gunnery. In the upheavals of 1978–80 a great many trained personnel were lost in action, were purged or went over to the Resistance. The Soviet-sponsored rebuilding which began in 1980 achieved only limited success. Its consequences for the artillery apparently included delivery of more M-30 122mm howitzers and the newer D-30. BM-13 and a limited number of BM-21 multiple rocket launchers were also provided. Some older weapons such as the BM-13, the M-1942 76.2mm mountain gun and the ZIS-3 76.2mm field gun are used only by DRA forces and heavy artillery is limited to one weak brigade. Otherwise most of the weapons are the same as those of the Soviet Army. DRA artillery seems to be used mainly in support of manoeuvre forces, especially those in the border areas, and in the defence of static positions. In both cases the guns are normally deployed by batteries in an attempt to stiffen infantry forces, and a large number have been captured and brought into action on the Resistance side.

Multiple rocket launchers MRLs have been used throughout the war. The DRA employs BM-13s mounted on ZIL-157 trucks. The Soviets have used both the 36-tube Grad-1 and the standard 40-tube BM-21, deploying them to defend key objectives such as airfields. The 40th Airfield Defence Battalion at Kabul Airport is known to have deployed BM-21s for defence against Resistance attacks.

But the widest use of the MRL is in offensive combat. Starting in 1984, it has become one of the primary weapons in the campaign against the agricultural infrastructure. Multiple rocket launchers have also been extensively used in support of combined-arms offensives. 122mm MRLs were employed in the 1984–85 offensives, delivering both preliminary barrages and fire strikes against positions located during the course of an operation. MRLs are frequently deployed in battery or even platoon-sized units under the command of motorised rifle or tank battalions on the offensive, giving them more decentralised and responsive firepower.

The 122mm MRLs have been used with incendiary sub-munitions. Called "firesticks" by the Afghans, these appear to be phosphorus weapons that allow a battery or battalion volley of 122mm rounds to start fires over a large area.

The BM-27 220mm MRL had entered combat by early 1984. Significantly increased numbers of BM-27s were used throughout Afghanistan in 1987–88. These are used to deliver high-explosive, bomblets and two different types of mine, the standard "butterfly" PFM-1 and a larger wedge-shaped version. BM-27s saw extensive use in the 1985 and 1987–88 Khost offensives.

All the divisions in Afghanistan have their MRL

battalions and regiments their MRL batteries. Since 1984 there has probably also been an independent, army-level MRL regiment in Afghanistan. This probably includes one or more battalions of both BM-27s and BM-21s.

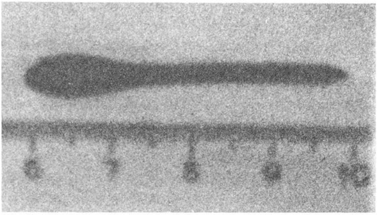
M-30 M-1938 122mm howitzer The M-30 has seen extensive combat in Afghanistan, where it has been the standard DRA field howitzer throughout the war. When the Soviets invaded, at least one of the motorised rifle divisions involved – the 360th Motorised Rifle Division, pre-war a Category III-readiness formation in the Turkestan Military District – used the M-30 as its standard 122mm howitzers.

D-30 M-1963 122mm howitzer The D-30 is the standard Soviet howitzer in the war in Afghanistan, being used at both regiment and division level. The DRA has also obtained a number of D-30s, some of which have fallen into the hands of the Resistance along with M-30s and 76.2mm weapons.

M-46 M-1954 130mm field gun The M-46 first entered combat in Afghanistan with the 40th Army heavy artillery brigade in the initial invasion. Some may have remained when the brigade was withdrawn in 1980. By 1984 there were substantial numbers in Afghanistan. They were sometimes seen to be decentralised, with batteries or even platoons apparently under the operational command of motorised rifle battalions.

2S3 M-1973 SO-152 152mm SP howitzer 2S3s have seen combat in Afghanistan since soon after the invasion. The divisional 152mm battalions of some, if not all, of the Soviet motorised rifle divisions in Afghanistan seem to have been equipped with these weapons. They have been employed in the long-range fire role, destroying Afghan villages and the agricultural infrastructure. But their most common use has been as "accompanying artillery", with batteries and battalions going into the field in direct support of combined-arms mechanised battalions. Their main task is to fire preliminary barrages and give fire support as the ground troops advance. They are also used to manoeuvre with tanks, BMPs and APCs. The relatively high weight of the piece has been a limitation at times.

By 1984 the Soviets had started to use 2S3s as escorts on the Salang Pass convoy route. At first the guerrillas misidentified them as main battle tanks, expecting them to have the MBT's limited main gun elevation and so engaging them from forward slopes. The 2S3s replied with direct, high-elevation rapid fire with beehive rounds containing thousands of steel flechettes. This was not the first use of beehive rounds by Soviet artillery in Afghanistan. While the Soviet Army in Afghanistan has



Flechettes are employed in Afghanistan, dispensed from beehive rounds fired primarily by 152mm howitzers. They were used heavily in the 1987–88 Khost battle. *(National Islamic Front of Afghanistan)*

never faced the sort of massed infantry attacks that led the US Army in Vietnam to adopt the beehive round, it has still proved useful. The 152mm howitzer is the only artillery weapon known to be using beehive rounds in Afghanistan, although it has been reported that such ammunition is used by a broad range of weapons, down to the AGS-17 30mm automatic grenade launcher.

2S1 M-1974 SO-122 122mm SP howitzer The 2S1 was apparently introduced to Afghanistan during the course of the war, replacing towed weapons at regiment and division level. It is said to equip the three tank and motorised rifle regiments the Soviets claim to have withdrawn from Afghanistan in October 1986. It has however been reported that when the regiments paraded to go home, they did so with towed artillery, suggesting that they were in fact regiments from Soviet-based divisions sent into Afghanistan solely to make an impressive withdrawal for media consumption.

M-1975 240mm SP mortar This weapon was first reported in action, in the interior of Afghanistan. Its high-explosive rounds create extremely deep craters, and it is reported also to use sub-munition rounds.

Chemical weapons Though most of the chemical weapons delivery in Afghanistan is carried out by helicopters or fixed-wing aircraft, there have been reports of artillery using chemical munitions. A prisoner from the divisional artillery of the 103rd Guards Airborne Division told the Resistance that his unit was trained and equipped to use a variety of chemical munitions, lethal and non-lethal.

Any assessment of the fitness of Soviet artillery for a war in Europe based on its performance in Afghanistan would certainly be less valid than a comparable judgement of the US Army following Vietnam. Afghanistan is not the Soviet Union's Vietnam. It is a much less intense war.

What is significant about the use of artillery in Afghanistan is the insight into the gap between Soviet military theory and practice that it gives. The Soviet Army portrayed in the pages of *Red Star* and *Military Herald* is a formidable force indeed. Obviously, no army in the world can be expected to live up to its own publicity when the bullets and casualties are real.

This desire to minimise casualties is reflected in the Soviet balance of fire and manoeuvre in the war. Starting in 1983, they have stressed firepower first and foremost. This not only reduces losses but also emphasises a Soviet Army strength, its ability to put metal on target, while minimising a weakness, its difficulties in coming to grips with guerrillas on their home terrain. Artillery is the most efficient – though not the most responsive – way of applying firepower. Why Soviet artillery is not being used in a more responsive way in Afghanistan is something known only to the men who wear the black shoulderboards.

In 1986–87 the Soviets replaced many towed guns in Afghanistan with SP weapons in response to increases in Resistance firepower. More ACRV-2s and their equivalent command vans were seen. In 1987–8 long-range artillery and MRL fire with high-altitude air spotting were increasingly used instead of air strikes. Massed artillery took the place of both "air accompaniment" and helicopter close air support in the 1987 Jadji and 1987–8 Khost offensives. Artillery fire, directed by mountaintop observation posts or aircraft, was used instead of patrols for interdiction.

Study of artillery tactics in Afghanistan is valuable mainly for what it reveals about how quickly the Soviet Army learns the lessons of combat. Armies have a hard time adapting to guerrilla warfare, as the Americans found out in Vietnam and the British in Malaya. The Soviets are not exempt from this process, and their learning curve has been longer than most. However, despite all its flaws and limitations, the Soviet artillery, like the Army as a whole, can still get the job done.

Countermeasures and vulnerabilities

The Soviets realise that their artillery has weaknesses and vulnerabilities, enough for Col V. Ivanov, a leading artillery tactician, to express himself dissatisfied with the overall level of artillery performance. According to the late Marshal A.A. Grechko, former Minister of Defence, the 1973 Middle East war drew attention to the vulnerability of Soviet artillery. It showed that there would seldom be time to dig in guns and that NATO counterbattery fires would be a powerful potential threat.

The Soviets have tried to answer these concerns from the mid-1970s to the present. They have relied not on one answer, but have looked to a combination of hardware, tactics and operations. The linear deployment of Soviet towed artillery batteries, with 80–85% of their personnel without cover, greatly increases vulnerability to counter-battery fire. The effectiveness of Soviet artillery batteries depends heavily on a small number of technicians to direct and control the fire. If counterbattery fire hits any of the officers, senior NCOs or technicians, the battery's effectiveness will suffer disproportionately. Towed batteries are also more vulnerable to NBC weapons. Gun crews suffer from fatigue when wearing NBC suits and gas masks, which also make it hard to give or hear orders.

While Soviet target-acquisition systems form an impressive, complementary, overlapping system, their effectiveness is uncertain because of the time lag inherent in the processing and communicating of data. Part of the answer to this has been the increased use of SP artillery.

The combination of BMP and MT-LB radar vehicles, the ACRV-2 and command vehicles is an attempt to adapt target-acquisition means to the mobile battlefield. There are few static targets today, and NATO artillery using "shoot and scoot" tactics would be difficult to locate or destroy. The Soviet reliance on the COP for fire control, either on the basis of artillery reconnaissance or, frequently, of targets being spotted by the COP directly, creates direct and responsive target acquisition, as does the use of direct fire, though this is accomplished at the cost of increased vulnerability. The Soviet inability to use their artillery flexibly – a regiment's guns are often unable to support a neighbouring regiment once command has been decentralised – means that the Soviet numerical superiority will often not be brought to bear in mobile combat. The Soviets need their numerical superiority to compensate for their lack of flexibility. Their response time is also much greater than that of NATO artillery, and on-call fires are particularly difficult to use if they have not been pre-arranged. Units smaller than battalion are not netted into artillery COPs. Battalions are only in the artillery net when artillery is attached to the battalion or is in direct support. Regimental HQs cannot talk directly to divisional guns. This creates a ladder up which a request for artillery fire must climb, a time-consuming procedure.

Destroying, suppressing or blinding COPs would greatly reduce Soviet artillery effectiveness and, although the Soviets are less dependent on radio communications than NATO armies and train under simulated electronic warfare conditions, radio jamming could interfere with the crucial link between the COP and its firing battery or battalion. Similarly, breaking the links between artillery group and battalion headquarters will defeat any centralised fire plan. The Soviets will use field phones whenever possible, and will supplement them with couriers, but neither is likely to be practical in the heat of battle.

Counterbattery fire can reduce artillery effectiveness not only through shell damage, but by forcing enemy artillery and target-acquisition equipment to move. Today counterbattery fire is more important than ever before. In the 1973 War 60% of the Israeli fire missions were counterbattery. Artillery with HE and smoke ammunition, both greatly improved since the Second World War, is so important that no army can afford to allow the enemy to use it unhindered. Counterbattery missions may well receive an even higher priority in the future, especially as the increased effectiveness of air defences limits the use of aircraft against artillery positions (another lesson of the 1973 War).

The future

New weapons for the Soviet artillery will probably follow "two-track" lines, with more sophisticated and expensive weapons (SP in the case of tube artillery) going to high-readiness formations and cheaper, often towed, weapons to lower-readiness areas and export customers. While the Soviets are probably working on follow-ons for most of the systems currently in the inventory, it is likely that artillery improvement will be slower than that of main battle tanks or helicopters.

In 1983 the DIA estimated that three new artillery designs would enter production in 1985–88. Those are the M-1987 122mm SP howitzer, the M-1988 122mm towed howitzer and the M-1987 152mm towed howitzer. DIA estimates put annual production by 1990 at 500 each of the two towed types and 300 of the SP weapon.

The M-1988 appears to be the replacement for the D-30, which will then push the M-30 out of service at a relatively slow rate. The SP howitzer is probably a follow-on to the 2S1, using a new gun. The existence of the towed 152mm howitzer would suggest that not all divisional 152mm howitzers will be replaced by 2S3s.

Even more significant than the hardware is the accompanying process of tactical evolution and adaptation, much of which has already taken place since the mid-1970s. Computers could well change the way the Soviet artillery fights, although the broad outline will remain valid.

Unit organisation

Towed artillery battery
Total strength: five officers (battery commander, political officer, firing battery commander, two platoon commanders), one warrant officer (technical officer), 63–75 enlisted men (depending on type of gun), six guns, six artillery towing vehicles (trucks or tracked vehicles), one Ural-375, ZIL-157 or 131 heavy truck, one light truck, BTR-60PU M-1979 or BRDM-2U for COP, one GAZ-66 FDC van.
One HQ (one officer, two-plus enlisted men, one BRDM-2U or BTR-60PU M-1979)
One control platoon
One reconnaissance section
Two firing platoons
One firing battery HQ (GAZ-66 van)
One support section (one warrant officer, one cargo truck)
Batteries are being increased to eight guns. This process began in the late 1970s and early 1980s, starting in high-readiness divisions and non-divisional artillery. It is probably being achieved by adding an extra gun to each firing platoon.

Self-propelled howitzer battery
Organised in the same way as towed battery but with 55–60 total personnel for six-tube batteries, proportionately higher in eight-tube batteries. Each SP howitzer has a Ural-375 ammunition truck and an RPG-7/16 and RPK-74 for close-in defence. Battery assets include two ACRV-2s (one Type 1, one Type 2), one GAZ-66, one laser rangefinder and one cargo truck.

BM-21 MRL battery
Total strength: five officers, 56 enlisted men, six BM-21 MRLs, one Ural-375 reload vehicle per weapon, two GAZ-66, one light truck or BRDM-2U.

Towed artillery battalion
Total strength: 20–22 officers, 264 enlisted men (276 in heavy artillery battalions), 18–24 guns, 18–24 towing vehicles (trucks or tractors), four COP vehicles, one ZIL-131 FDC van, 20 trucks. (Personnel strengths higher in 24-gun battalions.)
One HQ platoon
  HQ section (includes unit commander, with his COP, chief of staff, political officer, operations officer, and intelligence officer)
  Signals section (one truck, one BRDM or light truck, under communications officer)
  Reconnaissance section (under intelligence officer; 20 men, one PRP-3 (BMP M-1975) with Small Fred radar, one laser rangefinder, one jeep, one truck)
Three artillery batteries
One service platoon
  Medical squad
  POL squad (two tank trucks)
  Maintenance and supply platoon

BM-21 MRL battalion
Total strength: 23 officers, 234 enlisted men.
One HQ platoon (seven officers, 24 enlisted men, nine trucks, two command vehicles [usually BTR variants])

Three MRL batteries
One support platoon (one officer, 42 enlisted men, 25 trucks)

Self-propelled howitzer battalion
Organised in the same way as towed artillery battalion, with total personnel of 220–230 in 18-tube battalions. Battalion HQ includes two additional ACRV-2s (one Type 1, one Type 3). The support section includes 14 trucks – including ammunition carriers and tank trucks – and one jeep. In some units MT-LBs may replace trucks.

Artillery regiment
Total strength: 99 officers, 966–1,200 enlisted men (more in 24-tube battalions), 54–72 guns, 18–24 MRLs, 0–72 towing vehicles, 16 POL trucks, 32 vans, 225 general-purpose trucks, 22 jeeps
One HQ and service battery (27 officers, 144 enlisted men, 52 trucks, five command vehicles [usually at least three BTR variants], and BTR-60PUs or ACRV-2s)
Three artillery battalions
One MRL battalion
One target-acquisition battery (12 officers, 90 enlisted men, two command vehicles [BTR variants, tracked vehicles or BRDM-Us], one Big Fred SP radar, one Small Fred SP radar, one End Tray radar, two battlefield surveillance radars, one counter-mortar or counterbattery radar, one radar direction-finder/ESM set, one sound/flash-ranging set, two laser rangefinders, one UAZ-452 computer van [may be replaced by tracked vehicle], six jeeps, seven GAZ-66, four vans)
- HQ platoon
- Sound/flash-ranging platoons
- Two surveillance radar sections
- One reconnaissance platoon
- One topographic survey section
- One meterological survey platoon
- One radar section
- One communications platoon

The composition of artillery regiments varies. Divisional MRL battalions, previously independent, became part of the artillery regiment in the late 1970s. The standard mid-1970s artillery regiment had two 122mm (D-30 or M-30) battalions and one 152mm howitzer (D-1) battalion in motorised rifle divisions. Tank divisions had three 122mm howitzer battalions. In the mid-1970s one of the tank division's battalions was converted to 152mm SP howitzers. The motorised rifle division's 152mm battalion also started converting to SP howitzers, as did the 122mm battalions in both types of division. By 1986 tank division artillery regiments in Group of Soviet Forces Germany and, presumably, other high-readiness areas consisted of two 24-tube 2S3 battalions and one 24-launcher BM-21 battalion, while each of the four manoeuvre regiments had one 24-tube 2S1 battalion. Motorised rifle divisions were the same, but with a third 2S3 battalion in the artillery regiment. By 1986 the divisional BM-21 battalions in GSFG had 24 launch vehicles each.

Army-level independent artillery regiment/brigade
Originally a regiment with three 18-gun battalions (usually two with M-46, one with D-20). Since the late 1970s some of these units have been upgraded in one or all of the following areas:
Equipment (152mm towed and SP guns replace M-46s, 2S3s replace D-20s)
Battalion size (24 tubes against 18)
Unit size (three-battalion regiments have become four-battalion brigades, with two battalions each of guns and howitzers)
A target-acquisition battery has also been incorporated in each case.

Army-level independent rocket launcher regiment
Three 18-launcher BM-27 battalions (BM-21s may still be used in some units), plus HQ and target-acquisition batteries.

Artillery division
One divisional HQ (14 officers, 43 enlisted men)
Two field gun regiments (54–72 tubes) or brigades (72–96 tubes) equipped with 130mm M-46 or 152mm 2S5 or M-1976
Two howitzer regiments (54–72 tubes) or brigades (72–96 tubes) equipped with 152mm D-20 or 2S3
One or two anti-tank regiments (each 36 guns, 27 ATGM BRDMs) or brigades (each 48 guns, 36 ATGM BRDMs)
One or two MRL brigades (each 72 BM-27 or BM-21)
One air-defence battalion (as for motorised rifle division)
One target-acquisition battalion (40 officers, 300 enlisted men, 24 trucks, three counterbattery radars, six End Tray meteorological radars, three ground surveillance radars, six sound and flash ranging sets, nine laser rangefinding sets)
One motor transport battalion (25 officers, 350 enlisted men, 202 trucks)
One signals company (five officers, 57 enlisted men, 15 trucks)
Division services command (*tyl*) (30 officers, 250 enlisted men, 74 trucks)
- One maintenance battalion
- One ordnance company
- One ammunition-handling company
- One medical unit
- Divisional depots

Some divisions have three-battalion artillery regiments with 18 or 24 tubes per battalion; others have four-battalion brigades, again with 18 or 24 tubes per battalion.

Some lower-readiness divisions may be missing regiments or brigades.

34 Guards Artillery Division was reported in 1986 to have consisted of four firing brigades, equipped respectively with D-20s, 2S3s, BM-27s and a mix of M-1976s and 2S7s (72 tubes in each case).

Artillery divisions may have one or more anti-tank regiments, used as part of front or army-level anti-tank reserves.

Divisions apparently standardise on a single type of towing vehicle. KamAZ-4310, Ural-375D (apparently the most common type in the mid-1980s) and ZIL-131 trucks are used as prime movers in towed artillery units. Artillery tractors remain in service, probably mainly in tank divisions or where wheeled vehicles would be impractical. The MT-LB is used mainly to tow anti-tank guns, although they have also been used to tow howitzers. Towed and SP batteries both can use MT-LBs with armoured rooftop panniers as ammunition carriers. Other divisions use older types such as the ZIL-151/157.

Artillery in echelons above division include artillery divisions (usually assigned to front level), RVGK (*Stavka* reserve artillery) high-power artillery brigades (held directly by the high command and usually assigned down to front or army level), heavy artillery brigades (front level), independent artillery regiments or brigades (army level), and independent MRL regiments or brigades (army level). In addition, there are SSM and air defence artillery formations.

Each army and some corps have at least one artillery brigade or regiment. In addition, there are 10–12 "high-power" artillery brigades in the Soviet Army. None is deployed outside the Soviet Union, most being concentrated in the western military districts, with at least one in the Far East. These brigades have been used since before 1941 as a way of centralising a mass of potentially decisive firepower. They apparently retain their traditional title of "high-power artillery" (*artilleriya bolshoy moshchnosti*). In 1944 a third of artillery divisions and brigades were considered "Supreme Command Reserves". After the war they were in part equipped with super-heavy artillery and eventually assumed a nuclear-delivery mission; they are apparently still nuclear-capable. Their equipment now includes 2S5, M-1976 and D-20 152mm weapons. They would be used in co-ordination with SSM-equipped units. Each brigade has four battalions, each of 18–24 tubes.

Another type of formation, the independent heavy artillery brigade, consists of two to four battalions, usually divided between 240mm mortars and 180mm and 203mm tube artillery.

Artillery units often have a separate set of "training guns" for use while the unit's first-line guns remain in storage, except for a few used for familiarisation and large-scale manoeuvres. It is difficult to determine which guns are for training and which are the first-line equipment. While the Soviets often introduce new equipment into Category I divisions and then let it filter down the readiness categories, this is not always the case, and the future will doubtless see some low-readiness units with new equipment while some Category I formations retain the older weapons.

The Soviet M-1937 82mm mortar is the Afghan Resistance's standard indirect-fire weapon. Both Soviet (shown here) and Chinese-built versions are used. *(David C. Isby)*

Mortars

Size	82mm	120mm	160mm	240mm
Designation	M-1937	M-1943	M-1953	M-1952
Calibre length	14.9cal	15.4cal	28.5cal	22.4cal
Weight (firing)	56kg	274.8kg	1,300kg	3,610kg
Length (travelling)	1.22m	3.519m	4.86m	6.51m
Height (travelling)	–	1.63m	1.69m	2.21m
Width (travelling)	–	–	2.03m	2.49m
Elevation limits	+45°/+85°	+45°/+80°	+50°/+80°	+45°/+65°
Bore	smooth	smooth	smooth	smooth
Loading	muzzle	muzzle	breech	breech
Firing	drop	drop & trigger	trigger	trigger
Max rate of fire	15–25rpm	12–15rpm	2–3rpm	1rpm
Sustained (per hour)	–	100 rounds	–	–
Traverse	6°	8°	24°	17°
Max range	3.04km	5.7km	8.04km	9.7km
Min range	100m	460m	750m	1,500m
Ammunition types	F-833 HE, WP	F-843 HE, WP, smoke	F-853A HE, smoke	F-864 HE
Ammunition weight	HE = 3.05kg WP = 3.41kg	HE = 15.4kg	HE = 41.5kg	HE = 100kg
Muzzle velocity	211m/sec	272m/sec	345m/sec	362m/sec
Crew	5	6	7	8
Carriage	truck-carried, bipod	2-wheel towed, bipod	2-wheel towed	2-wheel towed
Towing vehicle	APC or truck	GAZ-66, MTLB	ZIL-157, BTR-152, Ural-375	AT-P, AT-L, AT-S, Ural-375
Unit of fire	120 rounds	50–80 rounds (42 HE, 8 WP)	60 rounds	–
Battery impact radius	–	150m	–	–

82mm and 120mm mortars can fire illumination rounds.

Tactical data (M-1943)
Normal distance behind FEBA: 0.5km offensive, 1.0km defensive.
Time for battery to leave firing position (day/night): 5.5/8min.
Time for battery to move one kilometre (day/night): 2.5/3min.
Time to occupy fire positions (day/night): 12/18min.
M-1943 accuracy: At two-thirds range, PER = 32m, PED = 17m; at maximum range, PER = 51m, PED = 24m

Mortars suited the needs of the Soviet Army superbly during the Second World War. Simple and effective, they gave Soviet infantry commanders their own "jacket-pocket artillery", available when and where they were needed, and could go anywhere an infantryman or pack animal could walk. Mortar shells, with their thin casings, large explosive charges and plunging trajectories, are more effective than howitzer shells, even if the mortars lack the range and accuracy of howitzers.

Today's mortars are not very different from those of

M-1943 120mm mortar in firing position. *(US Army)*

M-1943 120mm mortar in travelling position. *(Charles Yust)*

1915, and although Western armies have replaced their Second World War mortars with lighter, longer-range weapons, the Soviets continue to rely on the wartime 120mm M-1943. An intended replacement, the 120mm M-1965, was apparently not put into service. The 82mm M-1937, M-1941 and M-1942 series of mortars also remain in service with airborne and special forces battalions.

There have been repeated reports of a new Soviet 120mm mortar seeing action in Afghanistan. These may refer to the 2S9 120mm SP weapon, the 2S12 120mm mortar (which may be both towed and SP), or yet another weapon.

The standard Soviet mortar is the 120mm M-1943. Six of them, towed behind MT-LB APCs or GAZ-66 or -69 trucks, equip the mortar battery of many motorised rifle battalions, although they were originally regimental weapons. While the Soviets consider mortars to be artillery by definition, their crews are motorised riflemen who receive specialised mortar training at battalion level.

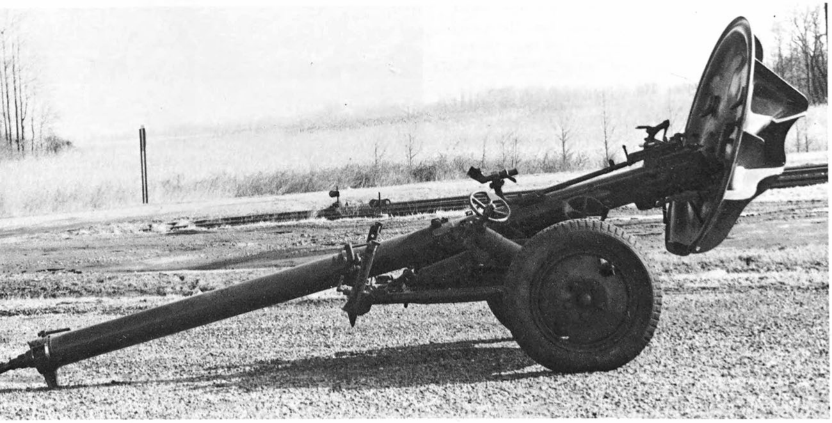
The M-1943 is a conventional, muzzle-loading, smooth-bore mortar. It can be either drop-fired (the shell instantly firing upon hitting the bottom of the tube) or fired by a lanyard trigger. The muzzle-brake-like device prevents inadvertent double-loading. All Soviet mortars are difficult to traverse rapidly, but the M-1943 can be shifted up to 6° without moving the bipod. The M-1943 is normally folded together with its bipod and towed on a two-wheeled tubular carriage, but can also be broken down into barrel, baseplate and bipod for animal packs or manhandling. It is simple and rugged, and its tolerances were deliberately kept large. Ammunition with either wrought or cast iron casings can be used, the latter giving increased fragmentation effect but less range. The M-1943 is a slightly modified version of the M-1938, the only differences being larger shock-absorber cylinders and more sophisticated elevating and traversing gear. The M-1938 and the M-1943 were interchangeable for many years, but the Soviets no longer use the M-1938, although it is still found in foreign armies.

The large post-war towed mortars are in only limited first-line Soviet service. 240mm mortar battalions may still serve in front-level heavy artillery brigades, though they are being re-equipped with self-propelled weapons. It has been reported that some howitzer battalions of motorised rifle divisions that may be called upon to operate in difficult terrain, such as the Caucasus, are cross-trained on these weapons and can use them if the situation requires.

M-1938 120mm mortar in firing position. It is distinguishable from the M-1943 by its shorter recoil-cylinder shock-absorbers *(US Army)*

The 240mm mortar is a particularly large weapon, requiring four men to load the huge mortar bomb into its vertically sliding breech block, which stands over 1.66m above the ground. Repeated reports have made reference to a nuclear capability for Soviet 240mm mortars, both towed and SP. This is very likely to be true of the SP version, less so of the towed weapon.

M-1952 240mm mortar (Soviet designation M-240) in travelling position on its two-wheeled carriage. *(US Army)*



M-1953 160mm mortar in travelling position on a wheeled carriage similar to that used with the 120mm M-1943. *(US Army)*

Combat usage

The 120mm and 82mm mortars have seen action in the Second World War and almost every war of insurgency since then. The effectiveness, ruggedness, simplicity and ease of movement of the M-1943 in particular mean that it will be in service for years to come.

Soviet-designed mortars have seen extensive combat with both sides in Afghanistan. The 82mm mortar, in both Soviet and Chinese-produced versions, is the standard Resistance support weapon (supplemented since 1984 by Chinese-made 107mm rockets and, since 1986, by Soviet-designed 122mm rockets). While its short range puts it within the reach of Soviet return fire, and the diverse sources of its ammunition mean that ballistic dispersion is high, the Resistance appreciates the light weight of both weapon and ammunition as well as its robustness and

simplicity. The complexities of mortar gunnery still elude many Afghans, however.

The 160mm mortar (including the earlier M-1943 version, no longer in Soviet service) has seen action with the Indian Army (who thought it a better weapon than the 120mm mortar despite its weight) in 1971 and with Arab armies since the 1967 War, including the Lebanese conflict.

The 240mm has been less widely used, although it has seen combat in Lebanon. Indian and Arab examples may also have seen combat.

Tactical employment

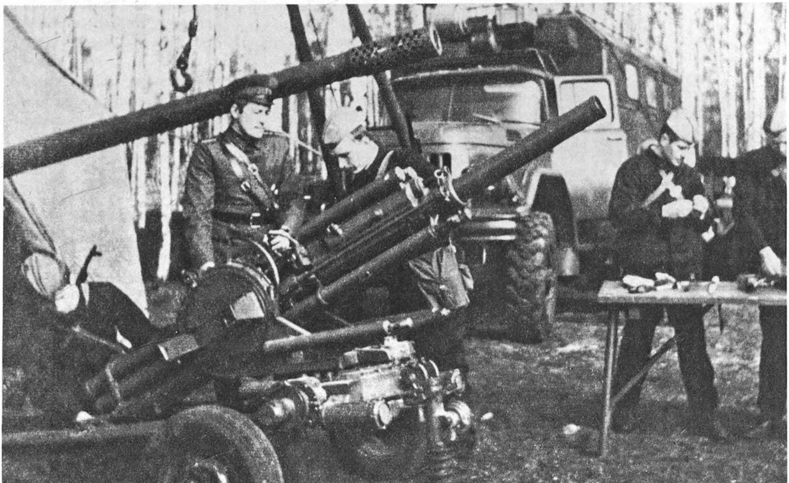
In action M-1943 batteries are normally deployed in a straight line 150–250m in length and 500–1,500m from the line of contact. The battery follows the motorised riflemen in the attack and can go into action in about twelve minutes. It will normally be employed as a single unit, although it can be split into two platoons or attached to companies. During the artillery offensive battalion mortars are included in Soviet centralised artillery command and will receive their fire orders from regimental or higher level if time permits. If not, the battery commander will direct fire from the command observation post. Using a GAZ-69 light truck or APC, he will position himself as far forward as possible and will be able to provide the battalion with close-in indirect-fire support, including high explosive, illumination and smoke rounds. In the mobile battle of a meeting engagement, this may be the only indirect-fire support a battalion can employ. If they have to displace while in action, the battery will move by alternate platoons unless covered by howitzer fire, when they would all advance together. On the defensive the mortars are well dug into their battery position, usually on a reverse slope. On the offensive only a small pit for proper setting of the baseplate is dug. For close-in defence each towing vehicle driver has an RPG-7/16 and the crews have small arms. The 82mm mortar would be used in a similar way, but closer to the front and normally from a covered position, while the 160mm would be used in the same direct-support role as the D-30.

AM 2B9 Vasilyek 82mm automatic mortar

Weight 800kg **Elevation** +0°/+80° **Traverse** 20° **Loading** breech **Max range** 5km **Direct-fire range** 1km **Practical rate of fire** 40–60rpm **RoF (cyclic)** 120rpm **Shell weight** 4kg **Shell types** HE, HEAT, smoke **Basic load** 90 rounds **Towing vehicle** GAZ-66, MT-LB, BMP, BTR **Feed** 4-round clips **Introduced** 1973 **Crew** 4–5

The 82mm AM (*avtomatichesky minomyot*, automatic mortar) 2B9 *Vasilyek* ("Cornflower") represents a significant increase in Soviet mortar performance. It returns the 82mm weapon to battalion level, but with increased capabilities.

Towed version of the *Vasilyek* 82mm mortar. Normally towed, the *Vasilyek* can also be portéed in a truck bed and can fire while mounted. *(US Army)*



Improvised *Vasilyek* mounts on MT-LB APCs. The primitive nature of this mounting, which provides no protection for the crew and results in an unstable weapon platform, calls into question the existence of an SP *Vasilyek*. Towed *Vasilyeks* have replaced M-1943s in at least some high-readiness BTR-equipped battalions.

The *Vasilyek* may have entered Soviet Army service as early as 1971, although it did not apparently appear in significant numbers until the mid to late 1970s. *Vasilyeks* were shown to foreign officers attending Soviet Army exercises in the early 1970s, although these weapons were possibly pre-production examples.

The automatic feed system is clip-fed, loading horizontally at the right-hand side of the breech mechanism. The most common mount is a single-axle, two-wheel, split-box-trail gun carriage with a front baseplate that allows for rapid traverse in direct-fire mode. HEAT rounds give an anti-tank capability in the latter mode.

There is said to be an SP version, mounted in the BTR-60 or BTR-70, although the breech mechanism could not be easily accommodated in the turret of such vehicles. *Vasilyek*-armed BMPs and BMDs are reported to have seen action in Afghanistan; this application may however be a field modification. The self-propelled *Vasilyek* may not have entered full-scale production.

Combat usage and tactical employment

Vasilyek has seen action in Afghanistan, the Afghan guerrillas calling the towed version the "little D-30".

Most significant of *Vasilyek*'s capabilities is its high rate of fire, which in the indirect-fire role makes it an effective suppression weapon against urgent targets such as ATGMs or machine guns. In the direct-fire role, its rapid fire allows a quick second round at close range.

There is little information on the tactical employment of *Vasilyek*. It is apparently used in much the same way as battalion 120mm mortars, though probably positioned closer to the FEBA. It would also probably advance with motorised rifle sub-units as "accompanying artillery" capable of quick reaction. The anti-tank role is likely to be secondary in the offensive, though *Vasilyeks* operating as "accompanying artillery" would be used against armoured counterattacks. On the defensive, *Vasilyeks* in prepared positions could supplement ATGMs. Smoke delivery would appear to be a primary mission.

The Soviets hold that accompanying artillery is needed to suppress the variety of anti-tank weapons, usually well emplaced, to be found in the depths of the defence. Without artillery the advancing forces become bogged down in costly duels with the AT weapons. *Vasilyek* seems admirably suited to this role.

Vasilyek is likely to be more effective than previous Soviet 82mm mortars. It probably uses a better designed round that produces more, further-reaching fragments. Because the first rounds of a mortar barrage are the most effective, often catching targets before they can take cover, increased rate of fire results in greater casualty-causing potential. In the anti-tank role *Vasilyek* probably has reasonable accuracy out to at least 500m, possibly 800m. *Vasilyek* is used by the Naval Infantry, replacing earlier 82mm mortars.

BTR and BMP-equipped regiments both have regimental-level *Vasilyek* platoons. Both types of platoon are 25-strong and have four *Vasilyeks* each. That of a BTR

regiment is reported to be mounted in BTRs, while its BMP equivalent is towed by GAZ-66s. Each platoon also has an armoured command vehicle, a BTR in BTR-equipped regiments, a BRDM in BMP-equipped regiments.

SO-120 2S9 M-1981 Anona SP assault gun-mortar and 2S12 SP 120mm mortar

Range 8.5km+ **Ammunition** HEAT, HE, smoke (?) **Elevation** −5°/+80° **Traverse** 360° **Vehicle** as BMD **Weight** 9,000kg **Height** 2.4m

Mounted on a BMD-2 chassis, the 2S9 was first paraded in 1985, in the markings of the Airborne forces. Its use of the BMD chassis suggests commonality with other airborne vehicles, and it is probably intended to replace the ASU-85. The lengthened, six-roadwheel BMD-2 chassis, minus the hull machine guns, is believed to have the same characteristics as the basic vehicle.

Mounted in a high conical turret – probably with reduced armour by comparison with that of the BMD due to its increased volume – the 2S9's only weapon has been identified by Western sources as a 120mm breech-loading mortar/howitzer capable of both direct and indirect fire. Ammunition load is believed to comprise a total of 60 HE and HEAT-FS rounds. The weapon may resemble an enlarged French 60mm gun-mortar, with a long tube and no muzzlebrake. Direct-fire rangefinding probably depends on a laser system mounted in a blister on the left-hand side of the turret. There are unconfirmed reports of a similar turret mounted on a BMP, MT-LB or 2S1 hull, indicating that roles other than the airborne are foreseen. The 2S12, towed or carried by a vehicle of as yet unknown type, is also based on a new 120mm mortar, possibly the same as that used in the 2S9.

Combat usage and weapons effectiveness

2S9s had entered action in Afghanistan by 1986–87, apparently playing a more active role than did the ASU-85s they probably replaced. In 1987 they were deployed on the Salang Pass route.

In the indirect-fire mode the 2S9's weapon is likely to have a longer range than the standard M-1943 120mm mortar. Ammunition limits – imposed by the small size of the vehicle hull – rule out sustained indirect-fire missions, although each 2S9 will probably be accompanied by a GAZ-66 ammunition carrier if required.

In the indirect-fire role the use of a laser rangefinder

2S9 120mm SP mortar. *(US Department of Defence)*

makes the HEAT-FS round accurate to 1,000m, possibly further. The 120mm round's size should give it a high degree of penetration.

There have been unconfirmed reports of a new 120mm mortar in use in Afghanistan; this may be the 2S12.

Tactical employment

The tactical employment of the 2S9 is uncertain, though it is likely to be seen as mobile armoured firepower for paratroopers, in the same way as the ASU-85. It may also serve as a SP mortar in airborne or even motorised rifle regiments, though a turret and rangefinder are unlikely to have been provided unless a significant direct-fire role was envisaged. Other versions will probably replace towed 120mm mortars in motorised rifle regiments.

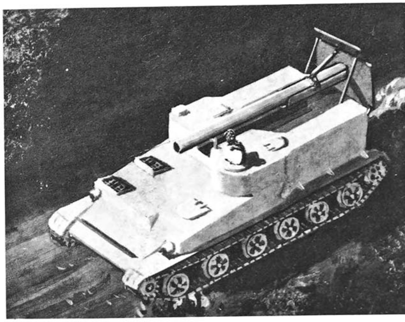
SM-240 2S4 M-1975 240mm SP mortar

Weight 30,000kg **Length** 8.5m **Height** 3.2m **Width** 3.2m **Ground clearance** 0.46m **Max road speed** 50km/h **Fuel capacity** 850lit **Road range** 500km **Fording** 1.1m **Gradient** 30° **Vertical obstacle** 1.1m **Engine** V-59 V-12 diesel, 520hp **Weapon** M-240S 240mm mortar **Calibre length** 22.4 **Max rate of fire** 1–2rpm **Sustained rate of fire** 1rpm+ **Ammunition types** HE, HE-RAP(?), ICM, nuclear, minelet, concrete-piercing **Max range (HE)** 12.7km **Min range (HE)** 0.8km **Muzzle velocity** 362m/sec **Shell weights** as M-1952 **Elevation** +45°/+70° **Traverse** 60° **Armour (maximum)** 15–20mm (hull) **Crew** 4 on vehicle, 5 on ammunition vehicle **Emplacement time** 3–5min **Displacement time** 2–3min

The SM-240 2S4 M-1975 (SM = *samokhodnaya minomyot*, self-propelled mortar, designation unconfirmed) was first seen in the mid-1970s but may have been in service earlier. It was not reported in East Germany until the early 1980s.

It represents a combination of two off-the-shelf systems. The chassis is similar to that of the GMZ tracked minelayer and SA-4 SAM launch vehicle, which is also used for the 152mm SP howitzer. The mortar is a modified version of the Boris I. Shavyrin design bureau's original M-1952. A breech-loader with a power rammer and loading system, it is probably mounted on a hydraulic cradle in the rear hull superstructure. It is lowered to the ground and positioned for firing on its baseplate, pointing away from the rear of the vehicle. There is probably some on-vehicle ammunition stowage, but this is likely to be limited.

Ammunition includes improved designs, although it is also capable of firing the 131kg F-864 HE round used with the towed M-1952 mortar. Range with this round is believed to be limited to 9.3km, and the longer range figure given above may require a HE-RAP round. There may



Artist's impression of a 2S4 240mm mortar in travelling position. To fire, the mortar baseplate is lowered to the ground, with the tube facing away from the vehicle. *(US Department of Defence)*

possibly be an ICM-style submunition round, using shaped-charge bomblets in fragmentation sleeves. Other ammunition includes 240mm minelet rounds, used in Afghanistan to deliver 20 standard PFM-1 mines over a 100–200m radius. Concrete-piercing rounds yield a substantial urban combat and anti-fortification capability. Chemical and nuclear rounds are also reported to have been deployed.

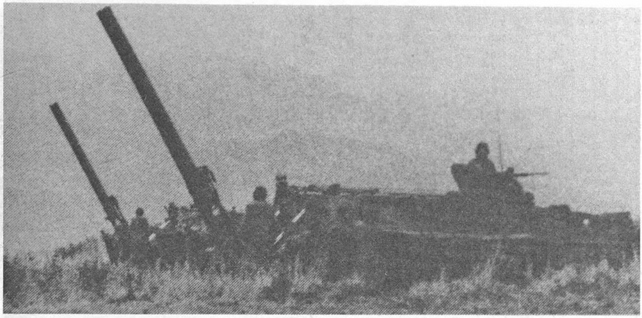
It is not known when the 2S4 became nuclear-capable, although SACEUR announced it to be so in 1978. The short range, lack of pinpoint accuracy and reduced crew protection of the 2S4 make it a less than optimum nuclear delivery system, although it could fire a larger nuclear round than those of 152mm weapons. A maximum yield of 2–5kT is likely.

Equipment fitted to the 2S4 probably includes standard night vision systems. NBC protection is limited. Swimming is probably not possible.

Tactical employment and combat usage

Nuclear-capable heavy artillery is found in the RVGK high-power artillery brigades. It is believed that this is the usual role for the 2S4, replacing the M-1952 towed 240mm weapon. Otherwise, it would probably be used at army or front-level in separate artillery regiments and brigades. Those examples reported in East Germany – if not there on exercise – are probably part of such formations. It has been estimated that total 2S4 production by the mid-1980s was only 200–400 vehicles.

2S4 batteries probably have six–eight mortar vehicles,



Two 2S4 SP 240mm mortars in firing position, with baseplates resting on the ground and the tubes pointing away from the vehicles. *(US Army)*

two or three ACRV-2s (one as a COP, one or two with the guns) and an ammunition-carrying vehicle – a Ural-375 or MT-LB – for each 2S4. Deployment would probably be in one or two firing positions. Like other Soviet heavy artillery, 2S4 batteries are more likely to perform old-style battery-sized fire missions than is field artillery.

The 2S4 first saw action in Afghanistan in about 1985, producing tremendous craters, it is used against villages and positions in caves. There is probably no more than a battery or, at most, a battalion of 2S4s in Afghanistan. They operate mainly to the north of Kabul, being used in the Panjshir Valley in 1985 and, according to unconfirmed reports, in Paktia in the autumn of 1985.

GP M-1966 76.2mm mountain gun

Calibre 14 cal **Weight** 780kg **Length (travelling)** 4.8m **Height (travelling)** 1.4m **Width (travelling)** 1.5m **Elevation limits** −5°/+65° **Traverse** 50° **Max RoF** 15rpm **Sustained RoF** 5–6rpm **Max range** 11km **Ammunition types** HE, HEAT, others(?) **Shell weight** HE = 6.2kg **Muzzle velocity** HE = 600m/sec **Crew** 6 **Carried** light truck, animal, helicopter

GP M-1966 76.2mm mountain gun. *(Soldat & Technik)*

D-30 122mm howitzer with the tow ring on the muzzle brake characteristic of early production versions and showing the unique trail-first travelling position of this weapon. *(US Army)*

The Soviet M-1966 (also known as the M-1969) 76.2mm mountain gun replaces the earlier M-1938 model. It is mounted on a split-box trail similar to that of the Italian-made L5 105mm howitzer, and apparently can also be disassembled. The recoil cylinder is located under the barrel. The rest of its construction seems close to standard Soviet practice.

Introduced in 1966 and seen in the 1971 "Yug" exercise, the M-1966 is believed to be used as regimental artillery in place of 122mm howitzers in approximately eight divisions that must operate in mountains or foothill-type terrain. It can be broken down into 10 horse pack loads. It appears to have been used in combat in Afghanistan.

D-30 122mm howitzer

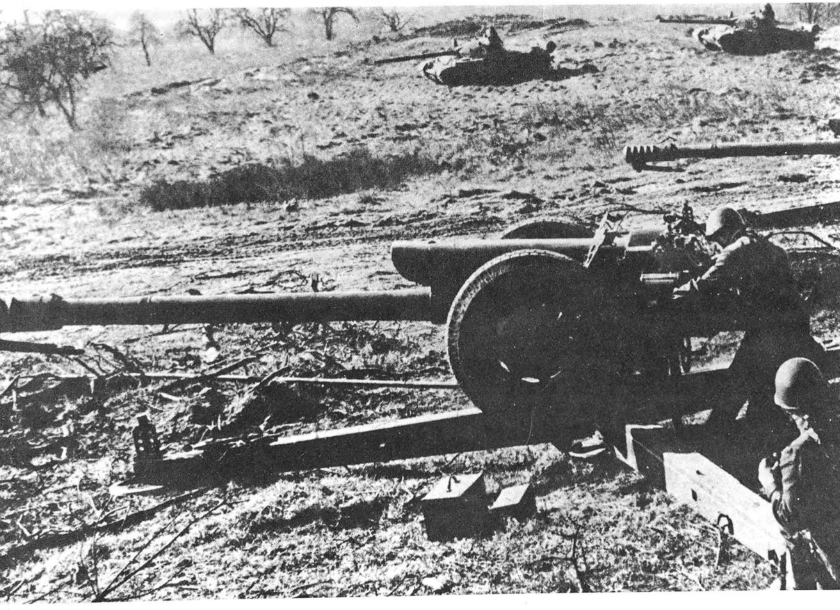
Industrial designation	2A18
Soviet nickname	*Sonyushka* ("Little Sonya")
Design bureau	Petrov ("D")
Calibre	35.5cal
Weight (firing)	3,150kg
Length (travelling)	5.4m
Height (travelling)	1.66m
Width (travelling)	1.95m
Track	1.85m
Elevation limits	−7°/+70°
Traverse	360°
Max rate of fire	7–8rpm
Sustained rate of fire	4–1.7rpm
Max range	15.3km
Point-blank range (2m-high target)	800m with HEAT (BK-6M)
Ammunition types	OF-462 or OF-462 ZH HE, BP-1 spin-stabilised HEAT, BK-6 or BK-6M HEAT-FS, smoke, chem, illum
Ammunition weights	HE = 21.8kg HEAT = 14.1kg (BP-1) HEAT = 21.6kg (BK-6M) smoke = 22.4kg illum = 22.4kg
Muzzle velocity	HE = 690m/sec HEAT = 740m/sec (BP-1) HEAT = 680m/sec (BK-6M)
Armour penetration	HEAT (BK-6M) = 580mm
Mount	3-trail, 2-wheel carriage
Crew	7
Towing vehicles	AT-P, MT-LB, ZIL-157, GAZ-63, Ural-375, KrAZ-214
Unit of fire	80 (64 HE, 12 smoke, 4 HEAT)

Tactical data

Normal distance behind FEBA: 3km offensive, 4km defensive, but less than a third of that if used as accompanying artillery.
Burst radius (battery pattern): 90–100m.
Time for D-30 units to leave firing positions (day/night): (battery) 5–7/9min; (battalion) 11/14min.
Time for D-30 units to move one kilometre (day/night): (battery and battalion) 3/3.5min.
Time for D-30 units to occupy new fire positions (day/night): (battery) 10–12/18min; (battalion) 23/32min.
Fragmentation effectiveness radius against armoured vehicles from one shell (against APC/IFV/SP gun): 1.0/0.5/0.75m.
Fragmentation area: 800m² per shell
Maximum crater size: 1.5m wide × 1.5m deep
Accuracy: In direct fire at 800m against a 2m-high target, using BK-6M HEAT rounds, probable error range is 0.4m in both vertical and horizontal components. In indirect fire, using HE shells, probable error range is 24m at 10,700m range and 23m at 13,800m range.
Probable error deflection is 7.6m at maximum range and 5.6m at 10km range.

The D-30 M-1963 122mm howitzer is the standard Soviet divisional and regimental howitzer. Introduced in 1967, it replaced the 122mm M-30 M-1938 and other Second World War-vintage artillery. Since then the D-30 has been produced in large quantities and has apparently proven most successful in service, combining simplicity and ruggedness with effectiveness. While it lacks the range and destructive power of NATO 155mm howitzers, the Soviets believe that deploying the D-30 further forward than comparable enemy guns will negate the range advantage, and that the numbers of these weapons made possible by their simplicity and ease of production will compensate for any individual limitations. Although the D-30 is being replaced by the SO-122 SP howitzer in many units, it will doubtless continue in service for many years.

The D-30 is often termed a gun-howitzer because of its long barrel. It embodies a semi-automatic, vertical sliding-wedge breech block. Like earlier Soviet 122mm



D-30 122mm howitzer (an early production model) giving direct fire in support of attacking tanks. *(Tom Woltjer)*

howitzers, the D-30 fires separate, fixed-charge ammunition and only two charges are available. The introduction of the D-30 coincided with that of improved types of 122mm ammunition with a more powerful type of explosive and a design superior to that of earlier, Second World War-era shells, although D-30s can use the same ammunition as the earlier M-30. Reportedly, a rocket-assisted HE projectile with a range of 21.9km has been developed for the D-30. It also fires a new non-rotating BK-6M HEAT round, showing the continued Soviet emphasis on a secondary anti-tank role for howitzers. A passive infra-red direct-fire night sight can be fitted.

The carriage of the D-30 and the way it is towed are both unusual but apparently efficient. The bulky recoil mechanism is mounted in a characteristic "hump" above the barrel. The D-30 is towed not by the trail but by the muzzle. A towing ring is fitted just behind the multi-baffle muzzle brake, although early production guns had the ring on the brake itself. The carriage is of a unique three-trail, 360°-traverse type. When going into action the crew unhitches the gun and lowers the central firing jack under the breech, which raises the carriage wheels high enough off the ground to clear the trail legs. The three trails, folded beneath the barrel in travelling position, are then unfolded and deployed, allowing the breech 360° rotation around a central pivot, although full elevation is not possible when the breech is directly over a trail. Pads at the end of each trail accept spades which secure the gun. While the arrangement may sound complicated, the Soviets point out that a Second World War howitzer could go from travelling to firing position in one minute, and the D-30 is quicker than that. A small shield between the wheels protects the gun crew.

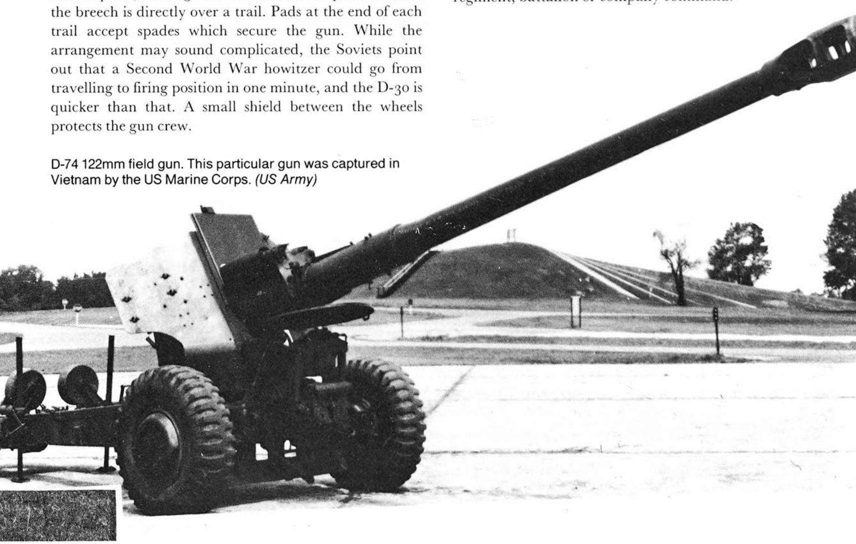
Combat usage

A small number of D-30s were introduced into combat in the Nigerian civil war in 1969. Larger numbers were used in the 1973 Middle East war. Alongside older guns, the D-30s were one of the mainstays of Arab field artillery strength and proved highly effective. According to some reports, D-30s were also employed as direct-fire anti-tank weapons. In the 1973 War the Syrians used a home-made SP version of the D-30, placing the gun in an open mount on a T-34 chassis. They have also been used by Cuban forces with Soviet "advisers" in Angola and Ethiopia. D-30s have also seen extensive combat in Afghanistan, including use by the Resistance of captured weapons.

Tactical employment

The D-30 is still a standard regiment and division-level howitzer. It serves alongside the 2S1 SP howitzer, which has been replacing it since the mid-1970s, in divisional artillery regiments, BMP-equipped regiments, half of the BTR-equipped regiments, and tank regiments.

Numerically the most important field artillery piece in the Soviet Army, the D-30 is used for most Soviet artillery missions. It is normally used for direct support of regimental and smaller-sized tank and motorised rifle units, forming the regimental artillery groups, organic regimental artillery and divisional guns attached down to regiment, battalion or company command.



D-74 122mm field gun. This particular gun was captured in Vietnam by the US Marine Corps. *(US Army)*

D-74 122mm gun and D-20 and M-47 152mm gun-howitzers

Size	122mm	152mm
Designation	D-74	D-20
Calibre	46.3cal	37cal
Weight (firing)	5,568kg	5,650kg
Length (travelling)	9.763m	8.138m
Height (travelling)	2.758m	2.758m
Width (travelling)	2.027m	2.027m
Ground clearance	0.39m	0.25m
Elevation limits	−5°/+45°	−5°/+63°
Traverse	60°	60°
Max rate of fire	6–7rpm	4–6rpm
Sustained rate of fire	3–1.5rpm	2–1.5rpm
Max range (HE)	24km	18.5km
Point-blank range (2m-high target)	1,060m (APHE)	800m (APHE)
Ammunition types	OF-472 HE, BR-472 APHE, smoke, chem, illum	OF-540 HE, BR-540 APHE, G-545 concrete-piercing, chem, illum, smoke
Ammunition weight	HE = 27.5kg APHE = 25.0kg Smoke = 21.7kg	HE = 43.6kg APHE = 48.8kg
Muzzle velocity	885m/sec, all ammunition	HE = 655m/sec APHE = 600m/sec
Armour penetration	APHE = 185mm @ 1,000m	APHE = 124mm @ 1,000m
Crew	10	10
Mount	split trail, 2-wheel	split trail, 2-wheel
Towing vehicle	AT-S, AT-L, Ural-375	AT-S, AT-L, Ural-375
Unit of fire	80 (64 HE, 12 smoke, 4 APHE)	60 (48 HE, 9 smoke(?), 3 APHE)

The D-20 can also use the BP-540 HEAT round (weight 27.5kg).

Tactical data
Normal distance behind FEBA: (D-74) 4km offensive, 5km defensive; (D-20) 5km offensive, 7km defensive.
Burst radius, battery pattern: (D-74) 90–100m; (D-20) 150m.
Time for D-74 or D-20 units to leave firing positions (day/night): (battery) 10/13min; (battalion) 11/14min.
Time for D-74 or D-20 units to move one kilometre (day/night): (battery and battalion) 3/3.5min.
Time for D-74 or D-20 units to occupy fire positions: (battery) 12/18min; (battalion) 23/32min.
Fragmentation effectiveness of one shell against armoured vehicles (against APC/ICV/SP gun): (D-74) 1.0/0.5/0.75m; (D-20) 1.5/1.0/1.25m
D-74 accuracy: In direct fire with APHE, probable error range in both deflection and vertical components is 0.2m at 1,000m range. In indirect fire with HE shells, probable error range is 55m at 16,010m range and 91m at 21,510m range.
D-20 accuracy: In direct fire with APHE, probable error range is 0.2m in the vertical and 0.3m in deflection at 1,000m range. Indirect-fire accuracy is believed to produce a probable error range of 42m at 11,500m range and 63m at 15,500m range, using HE ammunition. Probable error deflection is 11m at maximum range and 8.5m at two-thirds.
D-20 fragmentation area: 950m² per shell.
D-20 maximum crater size: 1.5m wide × 1.5m deep.

Older and heavier than the D-30, the D-74 M-1955 122mm field gun replaced the wartime A-19. D-74-equipped battalions are found in the heavy artillery battalions of army-level artillery brigades and regiments and front-level artillery divisions in place of M-46-equipped units and may replace D-30-equipped battalions in divisional artillery regiments when long range is more important than mobility.

The D-20 M-1955 152mm gun-howitzer is the Soviet Army's standard heavy howitzer, equipping the howitzer

battalions of army-level artillery brigades and artillery divisions, in which it replaced the ML-20. It was still in widespread use in this role in the mid-1980s. Many Soviet army-level artillery brigades are believed to have two battalions of new 152mm weapons and two of D-20s, that of Third Shock Army in Germany having one of the D-20 battalions replaced by an additional 2S5 battalion. The D-20 never fully replaced the D-1 in motorised rifle divisions, though some may use the D-20 in place of the D-1, either permanently or when the tactical situation requires. Introduced in 1955, the D-20 is now being replaced by newer 152mm weapons.

The D-74 and the D-20 are similar in most respects. The D-74's barrel is long (47cal) and low, while the D-20's is shorter (29cal), wider and has a large double-baffle muzzle brake. Both guns use the same short, split-trailed carriage with castoring wheels at the trail ends, along with spade-like baseplates. A circular firing jack and the castoring wheels allow quick traverse. Both guns have a scalloped, winged shield which is 9mm thick and not highly effective, a two-cylinder recoil mechanism above the prominently stepped tube, and the semi-automatic, vertical sliding-wedge breech used in most rapid-fire Soviet artillery. Both guns fire case-type, variable-charge, separate-loading ammunition. They retain a secondary anti-tank capability, with a low silhouette and APHE rounds, but they are still big weapons and difficult to manoeuvre, deploy or conceal.

Little is known about the 152mm M-47. It is likely to have been a competitor to the Petrov bureau's D-20 design, and also obviously owes some of its features to the M-46. Its reported maximum range of 20.5km is greater than that of the D-20. Production total is uncertain, as is the number serving with the Soviet Army, but both figures are likely to be small. The M-47 is not known to have been exported.

Combat usage

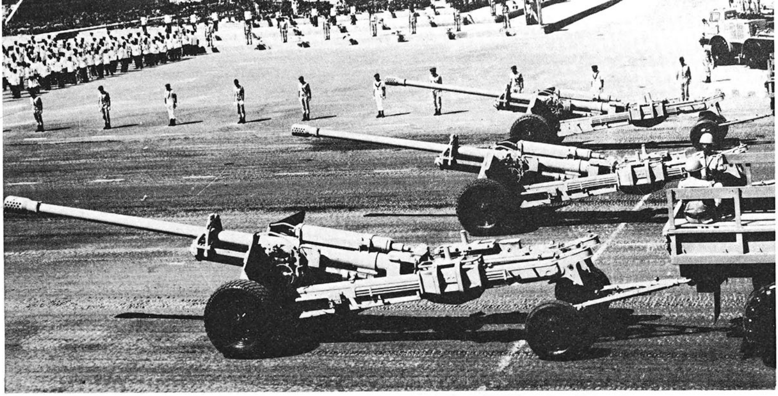
Combat usage of the D-20 has been limited, apparently because of its size. India used some in the 1971 War, and they were also used by North Vietnam.

The Egyptians used the D-20 in 1967 and 1973, and a small number were supplied to Nigeria during its civil war. Vietnam and China also have D-74s. The Vietnamese used only a handful of D-74s in action, employing them in the same way as they did the M-46 in I Corps. They were in action in the A Shau campaign.

Tactical employment

The D-20 and D-74 are normally attached down to divisional artillery groups for use in general support missions, although they are also used by army artillery groups. They are sometimes used as division-level weapons, replacing the D-30 and D-1 respectively. The D-20's 18.5km range makes it useful in the counterbattery role, but its larger size reduces mobility, even when towed by tracked AT-L vehicles (which is probably why it did not replace the D-1), and it is not deployed as far forward as other similar Soviet artillery, which limits its striking reach. The D-74 is also primarily counterbattery, but, like the D-20, it will also be used in the general support role when long range is needed, hitting targets such as reserve units, assembly areas, headquarters and supply routes.

The D-20 152mm gun-howitzer is probably nuclear-capable. *(US Army)*



M-46 130mm field guns of the Egyptian Army being towed by KrAZ-214s. Some 1,500 M-46s were in active Soviet service in 1986, with another 500 in war reserve. *(Egyptian Army)*

M-46 130mm field gun

Calibre	55cal
Weight (firing)	8,450kg
Weight (travelling)	7,700kg
Length (travelling)	11.73m
Height (travelling)	2.55m
Width (travelling)	2.45m
Track	2.06m
Ground clearance	0.4m
Elevation limits	$-2\frac{1}{2}°/+45°$
Traverse	50°
Max rate of fire	5–6rpm
Sustained rate of fire	3–1.7rpm
Max range	27.5km
Point-blank range (2m-high target)	1,170m (APHE)
Ammunition types	OF-482M HE, BR-482B APHE, smoke, S-46 illum
Ammunition weight	HE = 33.4kg APHE = 33.6kg illum = 25.8kg
Muzzle velocity	HE = 930m/sec APHE = 930m/sec
Armour penetration	APHE = 230mm @ 1,000m
Crew	9
Mount	split trail, 2-wheel
Tow vehicle	AT-S, Ural-375
Unit of fire	70 rounds

Tactical data

Normal distance behind FEBA for M-46 unit: 5km offensive, 9km defensive.

Burst radius, battery pattern: 90–100m.

Time for M-46 units to leave firing positions (day/night): (battery) 10/13min; (battalion) 11/14min.

Time for M-46 units to move one kilometre (day/night): (batteries and battalions) 3/3.5min.

Time for M-46 units to occupy new fire positions (day/night): (battery) 12/18min; (battalion) 23/32min.

Accuracy: In direct fire with APHE, probable error range is 0.2m in both vertical and deflection at 1,000m. In indirect fire with HE, probable error range is 43m at 18,420m and 62m at 24,740m.

Probable error deflection: 12m at maximum range, 8.4m at two-thirds range.

Long-ranged and accurate, the M-46 130mm field-gun is excellent for counterbattery work. Developed from the M-1936 130mm naval gun, it replaced the A-19 in the early 1950s. The M-46 was first seen in the 1954 May Day parade, and is designated the M-1954. The M-46's long, thin barrel ends in a pepper-pot perforated muzzle brake. The hydropneumatic recuperator and hydraulic buffer of the recoil system are located above and below the barrel, as on the D-1. The recuperator has a distinctive front-end collar support in front of the rearward-angled, winged gunshield. The breech block is a manually operated, horizontal sliding-wedge type, and the gun fires case-type, variable-loading ammunition. It is mounted on a standard split-trail, spade-end carriage with two large sponge-filled road wheels. When travelling the barrel is retracted so that the breech is above the trails. Provided with a two-wheel limber, the M-46 can be towed by a truck or armoured tractor at up to 50km/h. A modified 130mm gun with a longer barrel, recuperator and cradle appeared in the mid-1970s. Unlike the D-20/D-74, the M-46 has an

armoured recoil cylinder, which makes it less vulnerable to fragments from a near miss.

The M-46's long barrel and high muzzle velocity give it excellent anti-tank capability. Syrian M-46s are reported to have used an HE-RAP round in the 1973 War, but there have been no reports of a similar round in Soviet service. The M-46 is provided with direct-fire sights, including an APN-3 active/passive infra-red sight.

Combat usage

The North Vietnamese fielded no more than a few dozen M-46s during the later stages of the Vietnam War, but used them to great effect. Those who were on the receiving end of 130mm fire in the 1971–72 period consider the gun superior in range, accuracy and shell destructive power to any weapon used by US or ARVN forces, including the big 175mm M-107 SP gun. The M-46 played a major role in the Laos invasion and the fighting in the northern I Corps area of South Vietnam, especially in Quang Tri province.

The M-46s were surprisingly mobile. Towed by tracked vehicles, they could traverse any terrain, even jungle trails, which made them difficult to locate. Their flash was hard to spot in daylight, and North Vietnamese tactics were based on frequent changes of position to avoid counterbattery fire, although their long range protected them from most Allied artillery. Only air strikes could deal with them. On May 7, 1972, the USAF declared open season on M-46s, with combined teams of O-2E forward air controller aircraft and cannon-armed AC-130 gunships assigned to seek out the M-46s. They were not successful, as the M-46s kept moving and were harder to spot once the North Vietnamese protected them with SA-7 SAMs to keep the O-2Es at high altitude. Many airstrikes were devoted to identifying and eliminating individual gun positions, and even B-52s were used against them. Seldom in modern warfare have so few guns been such a problem to so many. Vietnamese 130mm guns were used in the 1979 Sino-Vietnamese War and in the frequent subsequent artillery duels. The Vietnamese Army remains in the mid-1980s one of the most proficient, large-scale users of Soviet artillery.

The M-46 was also used in the 1973 Middle East war. The Egyptians put them in army-level artillery brigades and used them, Soviet-style, in the counterbattery role. They were extremely effective, especially in the opening days of the war. The Egyptians co-located M-46 batteries with radio direction-finding equipment, which gave them rapid target acquisition against any Israeli target using its radio. The Israelis currently have battalions of M-46s, and these may have seen combat use.

PLO and Syrian M-46s were used in action in Lebanon. Before the 1982 campaign PLO M-46s bombarded targets up to 10km inside Israel. Widely used in Third World conflicts, the M-46 has outranged in counter-battery duels British-built 5.5in guns used by the Portuguese (in Guinea), South Africans (Angola) and British (in Aden and Oman).

M-46 130mm field guns being towed by AT-S tractors. *(US Army)*

The M-46 was deployed to Afghanistan in 1979–80 and is known to have been in action there with the Soviet Army.

The Indian Army used M-46s for counterbattery work in its 1971 campaign against West Pakistan, both as a divisional and corps-level gun. They thought highly of the weapon's range and accuracy.

Tactical employment

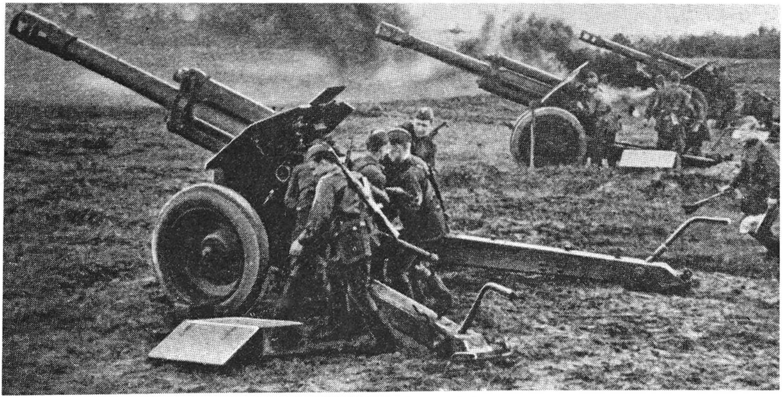
While it is now being replaced by the new 152mm weapons, the M-46 is a mainstay of Soviet artillery in echelons above division, in front-level artillery divisions (up to two regiments or brigades) and independent brigades and army-level artillery regiments and brigades (often with two M-46 battalions each). M-46s are frequently assigned down to divisional artillery group level. 130mm batteries on counterbattery missions are often co-located with target-acquisition facilities, especially radars or radio direction-finders.

D-1 (M-1943) 152mm howitzer

Calibre	24.5cal
Weight (firing)	3,600kg
Length (travelling)	7.040m
Height (travelling)	1.854m
Width (travelling)	1.86m
Track	1.8m
Ground clearance	0.37m
Elevation limits	−3°/+63.5°
Traverse	35°
Max rate of fire	3–4rpm
Sustained rate of fire	2–1.7rpm
Max range	12.4km
Point blank range (2m-high target)	510m (SAP)
Ammunition types	OF-530/A HE, SAP, chem, smoke, illum, G-530 concrete-piercing
Ammunition weight	HE = 39.9kg SAP = 51.1kg concrete-piercing = 40kg
Muzzle velocity	HE = 508m/sec SAP = 432m/sec concrete-piercing = 508m/sec
Armour penetration	SAP = 82mm @ 1,000m
Crew	7
Mount	split trail, 2-wheel
Towing vehicle (current Soviet)	AT-S, ZIL-151, Ural-375, ZIL-157
Unit of fire	60 rounds (48 HE, 9 smoke, 3 SAP)
Design bureau	Petrov Works
Soviet inventory (1986)	1,800 active, 1,000 war reserve

The D-1 is the only Soviet 152mm piece to lack nuclear capability.

D-1 152mm howitzers in traditional linear, closely spaced deployment. *(Chris Foss)*



Tactical data

Normal distance behind FEBA: 3km offensive, 4km defensive.
Burst radius, battery pattern: 150m.
Time for D-1 units to leave firing positions (day/night): (battery) 5–7/9min; (battalion) 11/14min.
Time for D-1 units to move 1km (day/night): (battery & battalion) 3/3.5min.
Time for D-1 units to occupy fire positions (day/night): (battery) 10–15/15–20min; (battalion) 23/32min.
Fragmentation effectiveness of one shell against armoured vehicles (against APC/ICV/SP gun): 1.5/1.0/1.25m.
Time to emplace single gun: 2min.
Accuracy: in direct fire, using SAP at 510m, probable error range in the vertical is 0.1m and in deflection is 0.2m.
In indirect fire with HE, probable error range is 35m at 8,500m and 47m at 11,200m.

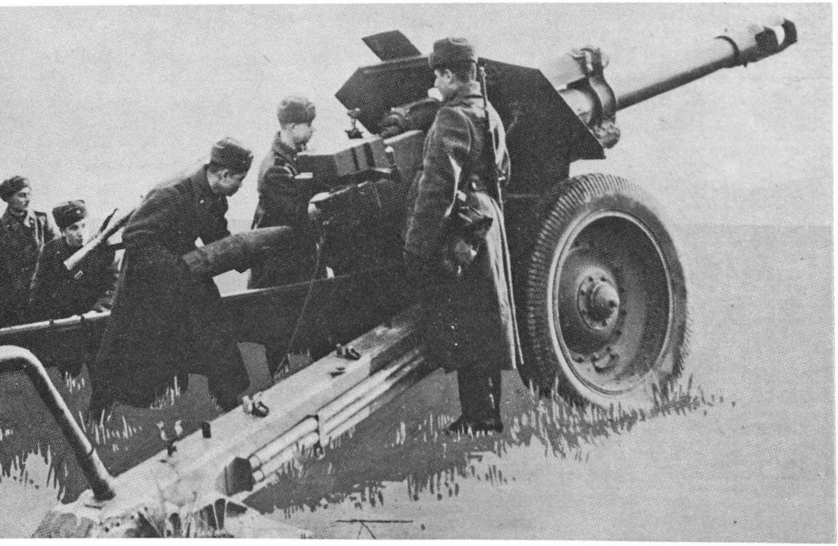
One of the last wartime artillery pieces in service, the D-1 equips the heavy howitzer battalion of some motorised rifle divisions. Replacement by SO-152 SP howitzers is well under way, but the D-1 will doubtless soldier on in lower-readiness units for years to come. It has the barrel of the 152mm ML-20 howitzer fitted with a large double muzzle brake and mounted on a straightened, modified M-30 122mm howitzer carriage. This gives it the capability of the earlier 152mm weapon, but it is lighter and more mobile. Like the pre-war 152mm howitzers, the D-1 has a screw-type breech and a hydraulic recoil system, in this case positioned over and under the barrel. The carriage is the standard box split-trail type, and the D-1 is recognisable by its compact size, sharply raked "tombstone" gunshield, and large metal road wheels.

Combat usage

The D-1 was used by the Soviet Army in the Second World War and in considerable numbers by the Arabs in 1967 and 1973. The North Vietnamese used the D-1 in action, and China may have done so.

Tactical employment

The D-1's lightness and mobility were achieved at the expense of range, and it must be positioned close to the front. The D-1 battalion is often used in general support as part of a divisional artillery group, although it is sometimes used in regimental artillery groups.



D-1 (M-1943) 152mm howitzer. *(Tom Woltjer)*

M-1976 152mm field guns towed behind KrAZ-260 vehicles. *(US Army)*

M-1976 152mm field gun and 2S5 M-1981 152mm SP gun

Calibre	47cal
Weight	9 tonnes
Max rate of fire	4rpm
Sustained rate of fire	2rpm
Ammunition types	HE, nuclear, chemical, HE/RAP
Max range	27km (HE), 37km (HE/RAP)
Crew	6
2S5 data	
Weight	30 tonnes
Length	9.5m
Width	3.2m
Height	2.8m
Clearance	4m
Ground pressure	0.6kg/cm^2
Crew	4 (plus 4 in ammunition carrier)

Other data as 2S3.

The M-1976 towed and 2S5 M-1981 SP 152mm guns – along with the 203mm gun, 220mm MRL and 240mm mortar – were deployed to upgrade Soviet long-range artillery capability in the 1970s. The M-1976 and 2S5 are replacing the M-46 and other tube artillery such as the D-74 and D-20 in artillery divisions and in front and army-level regiments and brigades.

The M-1976 is mounted on a split carriage with two wheels each side, a change from previous Soviet artillery designs. It is otherwise similar to standard tube artillery, with a small gun shield. It was first paraded in May 1985.

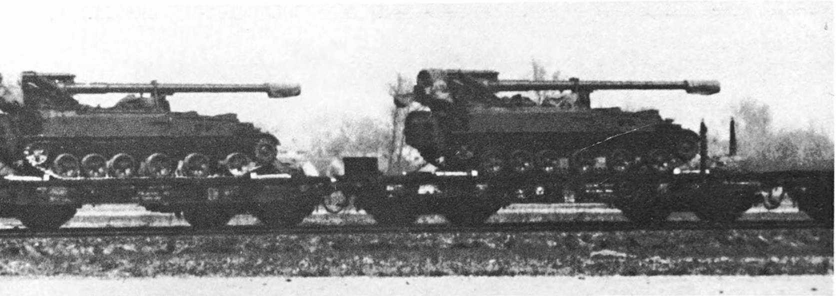
Soviet Army designation of the 2S5 *Donguz* (a Western rather than Soviet-assigned name) is unknown, but may be SP-152; its Russian nickname is *Glatsint* (Hyacinth). Its chassis is similar to that of the 2S3 152mm SP howitzer, being based on that of the GMZ mine-clearing vehicle. The roadwheel spacing is different from that of the 2S3, with the three rear wheels closely spaced and the forward three more spread out. A recoil spade is mounted at the back of the 2S5. The gun mounting is unprotected, much as on the original US M110 8in howitzer. The gun has the same multi-baffle muzzle brake as the 2S3. The 2S5 is reported to have entered Soviet service in 1981 and was first seen in Eastern Europe in 1982. In 1983 the DIA estimated annual 2S5 production at 450, decreasing to 400 in 1985–7 and ending in 1988.

Combat usage

The 2S5 and M-1976 saw action in Afghanistan in 1987. They replaced the M-46 as a source of long-range firepower in the 40th Artillery Brigade.

Tactical employment

The reported use of the new 152mm guns by RVGK high-power artillery brigades suggests that nuclear delivery will be a priority mission. Before the introduction of the new guns, nuclear-capable heavy tube artillery was



2S5 M-1981 152mm SP guns aboard railway flatcars. Similar guns were being operated by the 40th Artillery Brigade, based in Kabul, in 1987. *(US Department of Defence)*

concentrated in these brigades. Now the replacement of the 130mm field guns in artillery divisions by 152mm weapons gives these formations too at least a theoretical nuclear capability. The 2S3 howitzer is also reported to be nuclear-capable, but this remains unconfirmed.

The new 152mm weapons will also replace, in army and front-level artillery formations, such weapons as the M-46, D20 and D-74, as well as allowing their 2S3s to be shifted to divisions. These guns will not only make up army artillery groups (AAGs) in action, but will also be allocated down to become part of divisional artillery groups (DAGs).

S-23 M-1955 180mm gun-howitzer

Size	180mm gun
Designation	S-23
Calibre	47cal
Weight (travelling)	20,400kg
Max range	30.4km (HE) 43.8km (RAP)
Ammunition types	OF-23 HE, HE/RAP, 0.2kT nuclear, G-572 concrete-piercing
Shell weight	HE = 84.09kg, CP = 97.7kg
Muzzle velocity	790m/sec HE, 850m/sec RAP
Elevation	$-2°/+50°$
Traverse	44°
Max rate of fire	1rpm
Towing vehicle	AT-T, AT-S or KrAZ-255
Crew	16
Unit of fire	40 rounds

Tactical data
Normal distance behind FEBA: 7km offensive, 9km defensive.

First seen in the mid-1950s, the S-23, like the M-46, is based on a pre-war naval gun. It embodies a screw-type breech block typical of Soviet heavy artillery, and also features a multi-perforated muzzle brake and a cylindrical jacket around the barrel for much of its length. As with the M-46, the barrel can retract over the trails for towing. Two dual tyres, filled with sponge rubber, support the large box-section, split-trail carriage. A two-wheeled limber can also be used. The buffer recuperator is mounted under the barrel. Conventional ammunition is bag-type, separate-loading, variable-charge, and includes HE and "concrete-piercing" rounds. A rocket-assisted HE round (RAP) has been introduced, apparently during the 1970s. Currently the S-23 can also fire 0.2-kiloton-yield nuclear rounds. Although the S-23 has been thought to be nuclear-capable since its introduction, earlier Soviet artillery-delivered tactical nuclear warhead capability existed mainly on paper. The warheads were big, unreliable and short-ranged enough to imperil the weapon firing them, let alone any troops between them and the enemy. The S-23 apparently received its current nuclear capability during the 1970s (or possibly the late 1960s).

The S-23 provides accurate long-range nuclear and conventional fire. It was used by the Egyptian Army in 1973, and at least one example was captured by the Israelis. For many years Western sources referred to this weapon as a 203mm gun, designating it the M-1955. Examination of this captured gun revealed that the S-23 was in fact a 180mm weapon. In the 1970s S-23s were organic to the heavy artillery regiments or brigades of artillery divisions and, possibly, to independent heavy artillery brigades or RVGK high-power artillery brigades. It is likely that 203mm weapons have replaced S-23s in some front-level formations. The S-23 may have left Soviet service by the mid-1980s.

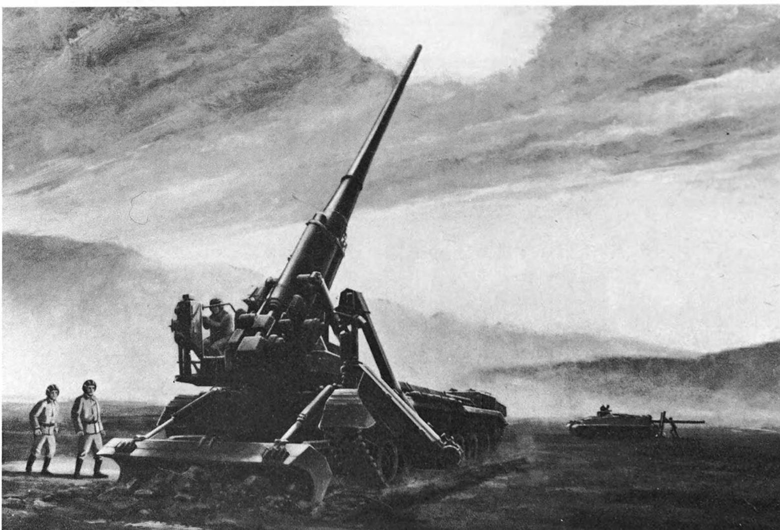
S-23 180mm gun-howitzer being towed by AT-T tractors. The double tyres and muzzle brake are characteristic of the gun. *(Tom Woltjer)*

180mm S-23 captured by Israeli forces. *(Marine Corps Gazette)*

BM-4M M-1931M 203mm howitzer and 2S7 SO-203 M-1975 203mm SP gun

Soviet designation	BM-4M	SO-203 (2S7)
NATO designation	M-1931M	M-1975
Weight (travelling)	21.8 tonnes	40 tonnes
Height	2.8m	3.5m
Length (travelling)	11.2m	9.5m
Width	2.7m	3.5m
Movement	towed	SP
Max range	18km	30km
Max rate of fire	0.5rpm	2rpm
Sustained rate of fire	0.3rpm	0.5rpm
Total production (1985)	200	400
Ammuntion type	HE, CP, nuclear (?)	HE, nuclear, CP
Elevation	−0/+60°	−3°/+65°
Loading mechanism	no	yes
Emplacement time	60min	2–4min
Crew	14+	6 (+4 on reload vehicle)
NBC defence system	none	partial

2S7 mount: **Max hull armour** 15mm **Engine** V-12 diesel, 450hp **Speed** 60km/h road, 20km/h cross-country **Fuel** 850lit

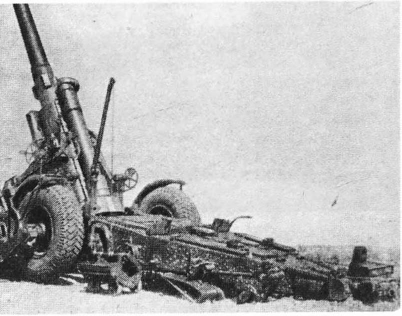


Artist's impression of a 2S7 opening fire, showing the rear spade deployed against recoil and the raised, exposed gunner's position on the rear of the mount. *(US Department of Defence)*

For a number of years the Soviets' heaviest nuclear artillery capability was represented by the 310mm and 420mm guns and mortars mounted on IS heavy tank chassis that were paraded through Red Square during the 1950s (they were in fact kept in storage between parades). Firing a winged, rocket-powered nuclear projectile, these weapons were built as an answer to the US 280mm nuclear-capable gun of the time. Nikita Krushchev thought that the building of these useless guns was "pointless imitation . . . showing the smallness of the military mind." The Soviets have indicated that these weapons equipped RVGK artillery brigades. They left the order of battle following the advent of FROG and Scud, which could deliver nuclear weapons more effectively.

Thus for several years the 180mm S-23 was the largest-calibre Soviet tube artillery weapon. Then, in 1973–76, 203mm-calibre heavy artillery re-entered active service when BM-4M M-1931M howitzers were taken out of storage, largely, it is thought, as a result of the lessons drawn from the 1973 Middle East war.

B-4M 203mm howitzer on its post-war wheeled carriage. It was still in use in 1986. *(US Department of Defence)*



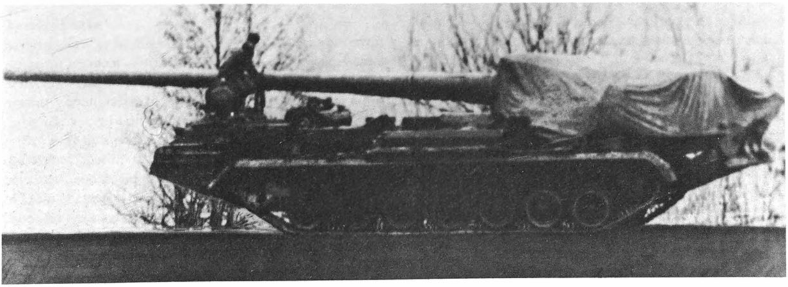
The BM-4M is an upgraded BM-4, its wheeled carriage replacing the track mounting used throughout the Second World War. Of standard Soviet design, with a screw-type breech, split trails, no gunshield and double wheels each side, the BM-4M has a hydraulic recoil buffer, a hydropneumatic recuperator, and a screw breech block. It is mounted on a large four-wheel carriage with a box trail, and fires variable bag-charge, separate-loading ammunition.

While heavy and relatively short-ranged by modern standards, the BM-4M is still a useful weapon, especially for demolishing fortifications and urban areas. Its return to service is a vindication of the Soviet policy of seldom disposing of weapons.

The 2S7 SO-203 M-1975 (designation unconfirmed) is one of the generation of Soviet long-range artillery that emerged in the mid-1970s. It may have supplanted the S-23 in some roles, although it did not directly replace any existing design, and is apparently going to serve along with the BM-4M for the immediate future. The DIA estimates that 400 had been produced up to 1985, by which time less than half had been deployed against NATO. Users include one 72-gun brigade stationed in East Germany as part of 34th Guards Artillery Division.

The gun is mounted on the rear of the chassis, which seems to be based on, or at least to share major components with, the SA-12 launch vehicle. An armoured cab at the front holds two to four crewmen, with the engine mounted immediately behind the cab. There is no turret, and hence no overhead cover for the crew in action. On-vehicle ammunition stowage is probably severely limited, and each gun is likely to be accompanied by a tracked or wheeled ammunition-carrier. The 2S7's power elevation and traverse is controlled from a small position to the rear of the breech. A power rammer is fitted.

A 2S7 203mm SP gun in travelling order. The vehicle is apparently based in the MT-T series of tracked transporters. *(US Department of Defence)*



The separate-loading ammunition is known to include at least HE, nuclear and CP. Chemical, ICM and other submunition rounds are also possible. Fuzes include point detonation, concrete-piercing, proximity, mechanical time and, probably, electronic time.

Both the BM-4M and the 2S7 are reported to be dual-capable. However, it appears that the BM-4M had this capability prior to the development of a nuclear round for the longer-ranged 2S7, which is a more logical choice for the nuclear delivery mission. The increased emphasis on this kind of weapon in recent years reflects the Soviet perception of the need to strike deep in the enemy's rear to help create operationally significant penetrations.

Combat usage and tactical employment

The original BM-4 was a standard Soviet heavy artillery piece during the Second World War. It was often used for the destruction of fortifications, sometimes, as at Koenigsburg and Berlin, by direct fire. There have been reports of the 2S7 in action in Afghanistan.

Currently both the BM-4M and the 2S7 are found in independent, front-level high-power artillery brigades. These formations, which date back to the 1920s, are designed to apply concentrated heavy firepower at the point of a breakthrough and then provide supporting fires through the depths of the defence. While these brigades have a nuclear delivery mission, it is by no means their only one.

In providing long-range conventional firepower, the 2S7 would probably be used as part of army artillery groups (AAGs). The Soviet concept of deep operations requires the simultaneous suppression of positions throughout the depths of the defence, requiring long-range fire strikes by either conventional or nuclear weapons. This is a mission that the 2S7 would perform well.

The Czech Army was apparently the first non-Soviet force to adopt the 2S7. The length of the gun tube is readily apparent. *(US Army)*

Obsolescent artillery: M-30 (M-1938) 122mm howitzer, A-19 (M-1931/37) 122mm field gun, ML-20 (M-1937) 152mm gun-howitzer

Size	122mm	122mm	152mm
Designation	M-30	A-19	ML-20
Model number	M-1938	M-1931/37	M-1937
Calibre	22.7cal	46.3cal	29cal
Weight (firing)	2,500kg	7,117kg	7,128kg
Length (travelling)	5.9m	7.87m	7.21m
Height (travelling)	1.82m	2.27m	2.26m
Width (travelling)	1.975m	2.46m	2.31m
Track	1.6m	1.9m	1.9m
Elevation limits	$-3°/+63.5°$	$-2°/+65°$	$-2°/+65°$
Traverse	49°	58°	58°
Max rate of fire	5–6rpm	5–6rpm	3–4rpm
Max range	11.8km	20.8km	17.265km
Point-blank range (2m-high target)	630m	900m	800m
Ammunition types	OF-462/A HE, BP-460A HEAT, D-462 smoke, S-462 illum, A-462 propaganda, chem	OF-462 HE, OF-471 HE, BR-471 APHE, G-471 concrete-piercing, smoke, chem, illum	OF-530/A HE, BR-540 APHE, SAP, OF-540/B HE, chem, illum, smoke, G-530 concrete-piercing, G-545 concrete piercing
Ammunition weight	HE = 21.8kg HEAT = 14.8kg smoke = 22.4kg illum = 21.0kg prop = 21.5kg	HE = 22.5kg (OF-471) APHE = 25kg smoke = 25.7kg	HE = 43.6kg APHE = 48.8kg
Muzzle velocity	HE = 515m/sec HEAT = 570m/sec	HE = 800m/sec APHE = 800m/sec	HE = 655m/sec APHE = 600m/sec
Armour penetration	HEAT = 200mm	APHE = 160mm @ 1,000m	APHE = 124mm @ 1,000m
Crew	8	8	9–10
Mount	split trail, 2-wheel	split trail, 2-wheel	split trail, 2-wheel
Towing vehicle (current Soviet)	ZIL-151, MT-LB, GT-T, Ural-375	KrAZ-214, AT-S, AT-T, Ural-375	AT-S, Ural-375
Unit of fire	80 rounds	80 rounds	60 rounds

Tactical data

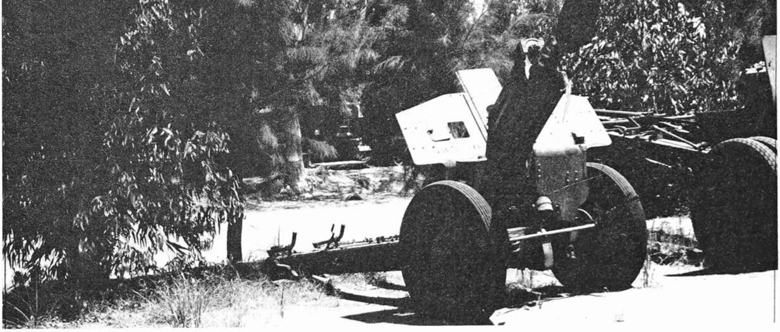
M-30 accuracy: In direct fire with HEAT, probable error range at 1,000m range is 0.6m in both vertical and deflection. In indirect fire with HE, probable error range is 25m at 7,900m range and 35m at 10,600m range.

A-19 accuracy: In direct fire with APHE or HE, probable error range at 1,000m range is 0.3m in both vertical and deflection. In indirect fire with HE, probable error range is 70m at 13,200m and 94m at 17,800m range.

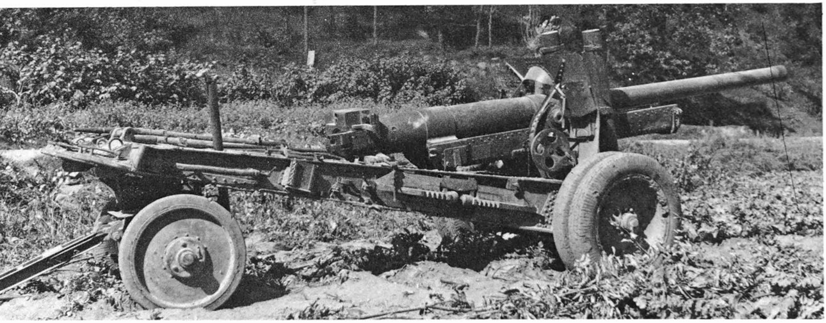
ML-20 accuracy: In direct fire with BR-540 APHE probable error range at 700m range is 0.2m in both vertical and deflection. Indirect fire with HE yields probable error ranges of 49m at 11,500m range and 64m at 15,500m.

These weapons were all developed before the Second World War and, though obsolescent, linger on as training equipment, in low-readiness units, in storage reserves and in paramilitary organisations such as DOSAAF, which trains secondary school students. All have been exported and have seen much action since 1945.

The 122mm A-19 M-1931/37 was a corps-level long-range counterbattery artillery weapon in the Second World War. It has a screw breech and hydraulic recoil system mounted beneath the gun tube. The tyres, originally solid, are now pneumatic on modern disc wheels. The carriage uses the standard box split trail, and the JSU-122 assault gun used the same gun. The A-19 was replaced in Soviet service by the M-46 and D-74. The Germans and Finns employed captured A-19s, and they



M-30 (M-1938) 122mm howitzer captured by Israeli forces in 1973, showing modernised wheels and tyres. *(Tom Woltjer)*



A-19 M-1931/37 122mm field gun, showing the two-wheel limber. This example was captured in Korea. *(US Army)*

were used by the Arabs throughout the Middle East wars. They have been built in China and widely exported to nations such as Kampuchea (Chinese version), Cuba, Guinea, North Korea (used by both Chinese and Koreans in 1950–53), Somalia, Tanzania, North Yemen and South Yemen. The Iraqis used A-19s in 1980.

Its ruggedness and simplicity have resulted in the A-19 seeing a great deal of combat in the past. Despite its age and weight, it will probably see more combat in the future.

The 122mm M-30 M-1938 was the standard Soviet howitzer until it was replaced by the D-30, and large numbers remain in Soviet service in first and second-line roles. The M-30 has the same carriage as the D-1. It has a screw-type breech, a hydropneumatic recuperator above the tube and a hydropneumatic buffer below. The Bulgarians and East Germans updated their M-30 carriages in the early 1960s, adding new wheels and tyres. The M-30's tactical use is identical to that of the D-30. The M-30 saw combat in the Second World War, Korea, Southeast Asia and throughout the Middle East. It was the standard Egyptian howitzer in 1967, and many were captured by the Israelis, who incorporated full battalions of them into their order of battle, though in recent years they have been used exclusively for training. The North Vietnamese used many M-30s, especially in the A Shau valley in 1968 and in the Laos invasion. The M-30 is still in Soviet front-line service today. In 1980 artillery units of the 360th Motorised Rifle Division and other units deployed in Afghanistan were equipped with these guns.

Well designed and sturdy, the ML-20 M-1937 152mm gun-howitzer was a major long-range weapon in the Second World War. Like most older Soviet artillery pieces it has a screw-type breech, hydraulic buffers and hydropneumatic recuperators, and fires case-type, variable-charge, separate-loading ammunition. Replaced in Soviet service by the D-20, it was used in the same way as that gun. The ML-20 was used in Korea, Vietnam and the Middle East.

Self-propelled howitzers

Designation	2S1 SO-122 M-1974	2S3 SO-152 M-1973
Soviet nickname	*Gvozdika* ("Carnation")	*Akatsiya* ("Acacia")
Weight, firing	16,000kg	27,500kg
Length, travelling,	7.3m	8.4m
Height, travelling	2.4m	2.7m
Width, travelling	2.85m	3.2m
Ground clearance	0.46m, variable	0.45m
Max road speed	60km/h	50km/h
Fuel capacity	550lit	850lit
Road range	500km	500km
Fording	Amphibious	1.1m
Water speed	4–5km/h	–
Gradient	65%	60%
Vertical obstacle	1.1m	1.1m
Engine	V-8 diesel, 240hp	V-12 diesel, 520hp
Armament	D-30 122mm howitzer	D-20 152mm howitzer
Calibre length	35.5cal	37cal
Max rate of fire	6rpm	4rpm
Sustained rate of fire	3rpm	2rpm
HE projectile/weight	OF-462/21.72kg	OF-540/43.51kg
HEAT-FS projectile/weight	BK-6M/21.63kg	BP-540/27.5kg
APHE projectile/weight	–	BR-540/48.8kg
Smoke projectile/weight	D-462/22.30kg	D-540/44.0kg
Illumination projectile/weight	S-462/22.4kg	S-540
Other ammunition types	Leaflet, HE/RAP, chemical	HE extended-range, HE/RAP, 0.2kT nuclear, chemical, beehive, HEAT
Max range, HE	15.3km	18.5km
Point-blank range (2m-high target)	800m, HEAT	800m, APHE
Muzzle velocity, HE	690m/s	655m/s
HEAT-FS	680m/s	–
APHE	–	600m/s
Armour penetration	580mm, HEAT	124mm at 1km, APHE
Rounds carried	40 (32 HE, 6 smoke, 2 HEAT)	46
Elevation	−3°/+70°	−3°/+65°
Traverse	360°	360°
Armour (turret)	15mm	15mm
Armour (hull)	20mm	20mm
Crew	4	4

Tactical data

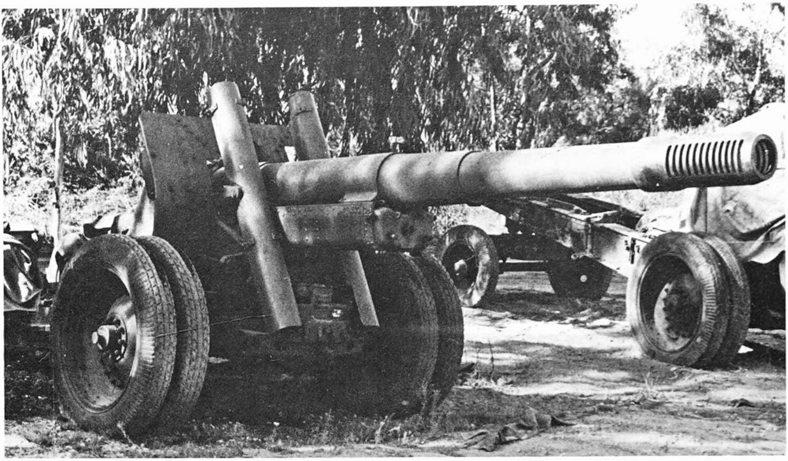
Distances behind FEBA (direct fire): 0.5–1.0km offensive, 1.0km defensive.

Upon occupying a new firing position SP batteries can be in action in about two minutes, rising to three or four minutes at night. Battalions would take about twice as long.

Burst radii are the same as for the D-30 and D-20 respectively.

These weapons provide long-range firepower while being able to keep up with the rapid advances and continuous combat operations demanded by Soviet operational and tactical thought. New fire-control equipment and a mixture of innovative and traditional tactics allow these weapons to acquire and hit targets with a speed and accuracy previously beyond the abilities of Soviet artillery.

Soviet self-propelled howitzers are excellent suppression weapons, and this is their primary mission, using both direct and indirect fire. The increased number of improved heavy artillery pieces available to the Soviet Army since the mid-1970s will be able to shoulder the burden of the counter-battery missions, allowing divisional and regimental weapons like the 2S1 and 2S3 to tackle the



ML-20 (M-1937) 152mm gun-howitzer captured by Israeli forces in 1973. The Soviets had 2,000 ML-20s, mainly stored, in the 1980s. *(Tom Woltjer)*

unarmoured tank-killing systems that pose such a threat to Soviet mechanised forces.

The need for increased artillery mobility and protection in both conventional and NBC environments probably became apparent to the Soviets in 1963–67, when development of these weapons is likely to have been initiated. This decision was subsequently borne out by the effectiveness of self-propelled howitzers in the Middle East and Vietnam.

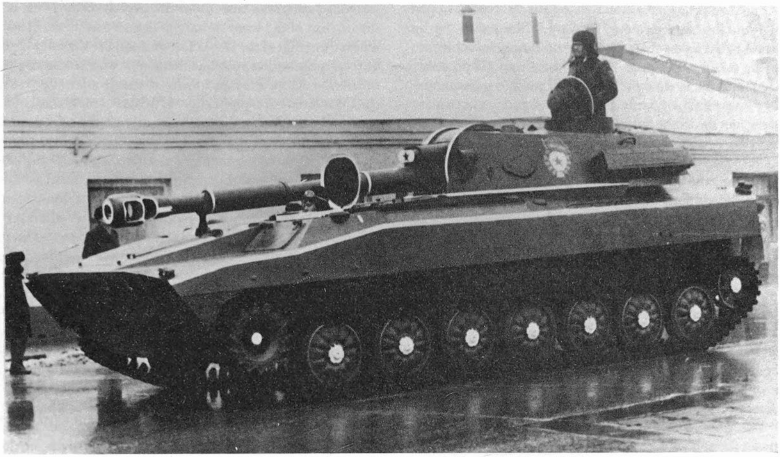
Each of these vehicles combines a fully developed howitzer with a fully developed chassis. The 2S1's chassis is an enlarged version of that introduced by the MT-LB armoured personnel carrier, and is powered by the same YaMZ-238V V-8 240hp water-cooled diesel. The ACRV-2 M-1974 artillery command and reconnaissance vehicle incorporates elements of the same basic design. The 2S3's chassis is based on that of the SA-4 Ganef SAM launch vehicle, again with the same engine. Both vehicles feature NBC defence systems which, to judge by their intakes, are probably similar to the overpressure and filtration system used on BMP-1 infantry combat vehicles.

The 2S1's engine is mounted in the right-hand side of the sloping boat-like hull front. There are seven roadwheels and two hydraulic dampers on each side, and the 0.4m-wide Hadfield steel dead track has metal–rubber contact on the links rather than the metal–metal of earlier Soviet dead track. Extra-wide (0.67m) track with "aggressive" grousers can be fitted for increased mobility on soft ground. Transmission is of the manual mechanical constant-mesh type, with five forward gears and one reverse. Steering is by clutch and brake. The 2S1 has a variable-height suspension system similar to that of the BMD airborne combat vehicle. This allows height to be reduced for air and rail transportation, for passing under low bridges, and to lower the vehicle's profile. It may also lock the suspension against gun recoil.

The 2S1's hull is divided into the standard three compartments. The driving compartment is on the left-hand side, separated from the combat compartment by the engine/drive train compartment. The combat compartment, at the rear of the hull, houses the commander, gunner and loader. The crew arrangement appears to be similar to that of Soviet main battle tanks, with the loader on the right-hand side of the gun breech, making loading difficult unless he is left-handed, and the gunner and commander lined up behind the driver, making all three vulnerable to a single penetration. The all-welded turret has a rigidly mounted basket and can be traversed by electric or manual power.

The 2S1 is fully amphibious, being powered in the water by twin hydrojets. A bilge pump handles most leakage. The boat-shaped hull front seems to be optimised for water crossing, and there are folding trim vanes for stability. The use of wider tracks would also allow river banks that might otherwise be obstacles to be surmounted.

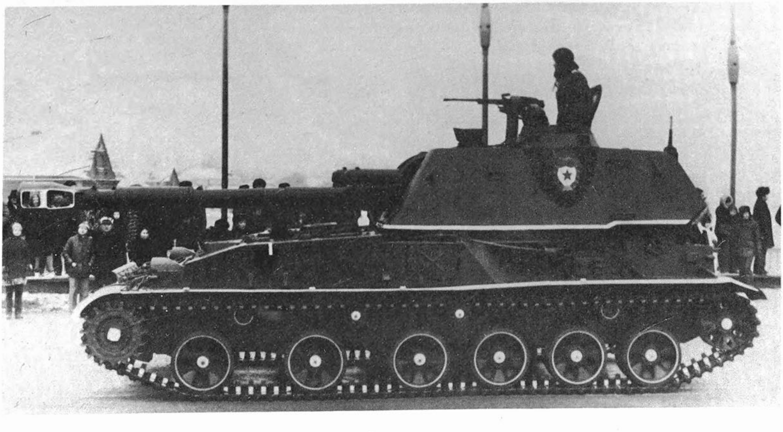
The 2S3's suspension differs from the Ganef SAM launch vehicle's, with only six roadwheels (the three forwardmost being widely spaced) and different spacing



between the four track-support rollers on each side. The engine, an older tank-type water-cooled V-12 diesel of about 520 hp, is in the front right-hand side of the vehicle. Internal layout appears to be standard two-compartment. The 2S3 is not amphibious. The turret is large and slab-sided, and lacks the usual loader's cupola on the right-hand side of the turret top. There is a large ammunition loading hatch on the right-hand side of the turret.

2S1 SO-122 (M-1974) 122mm SP howitzer of a Guards unit on its way to a parade. *(US Army)*

2S3 SO-152 (M-1973) 152mm SP howitzer of a Guards unit. The asymmetrical arrangement of road wheels is designed to support the enormous turret. *(US Army)*



Both vehicles have relatively thin but well sloped high-quality steel armour, however, like much Soviet armour that is less than 50mm thick, it may be subject to brittle failure on impact. Most of the armour is probably 14–20mm thick, though the turret front and gun mantlet may be as much as 30mm. The ribbed engine compartment cover on the right-hand side of the 2S1's hull front is probably made of aluminium.

The optics are similar on both vehicles. A periscopic sight for the gunner is mounted in front of the commander's cupola. A telescopic direct-fire sight, apparently similar to those of Soviet main battle tanks and using stadia reticle rangefinding, is mounted next to the gun barrel. The commander and driver both have several × 1-power TKP-165 vision blocks in their cupolas. The commander also has a rotating binocular device similar to the TKN-3 of the T-62 for use when closed down. A 400m-range OU-3GK white-light or infra-red searchlight is mounted alongside the cupola. The driver has a TVN-2B night driving system with 60m range. Most self-propelled howitzers have a single radio antenna on the turret. At least one mount per battery also has a second antenna.

The 2S1 howitzer is a modified version of the D-30 towed 122mm weapon. Mounted in the long, low turret, it has a power rammer, semi-automatic sliding-wedge breech block and an extractor which automatically pulls expended cartridge cases from the breech so they can be thrown out of the loader's hatch. The 2S1's muzzle brake differs from that of the D-30. The gun can fire the full range of D-30 ammuntion and, like the D-30, can also use any of the earlier M-30 122mm howitzer's projectiles. The 2S1 can also fire a 21.9km-range HE/RAP (rocket-assisted projectile) not yet reported to be in use with the towed gun.

The 2S3's gun is apparently a modified D-20 152mm howitzer with a bore evacuator behind the muzzle brake. It fires all standard D-20 ammunition as well as an extended (24km) range HE projectile, a 37km-range HE/RAP and, according to reports, a 0.2kT-yield AFAP (artillery-fired atomic projectile). The 2S3 uses power loading and has a semi-automated conveyor-belt loading system fed through the two small access ports in the turret rear. Two loaders from the ammunition-carrying vehicle crew pass the ammunition through these ports.

Combat usage

The 2S1 and 2S3 have seen combat in Afghanistan.

Tactical employment

The SP howitzer can be used for general or direct support,

Loading 152mm shells into the rear port of a 2S3 152mm SP howitzer.

as part of divisional or regimental artillery groups or attached directly to manoeuvre units.

2S1s are replacing towed D-30 and M-30 122mm howitzers as regimental and divisional artillery. Starting in the mid-1970s, the artillery strength of Soviet motorised rifle regiments was increased from a six-gun battery to a 24-gun battalion. In higher-readiness divisions D-30s equip only one regimental artillery battalion in each motorised rifle division, the other two regiments using 2S1s. Tank regiments in high-readiness tank divisions, which previously lacked organic artillery, are also receiving battalions of 2S1s. In divisional artillery regiments, 2S1s replace towed 122mm weapons one for one, although eight-gun batteries have been seen since the early 1980s.

2S3s replace towed D-1 152mm howitzers in the heavy howitzer battalion of motorised rifle division artillery regiments. They are also replacing one towed 122mm howitzer battalion in tank division artillery regiments, which previously had no heavy howitzers.

In 1978 17% of all the artillery in Group of Soviet Forces Germany was self-propelled; this figure was expected to reach 40% by the early 1980s. By 1986–87 all or almost all of the divisional and regimental artillery in GSFG was self-propelled. High-readiness formations in the Western USSR were probably being equipped at a similar pace. Production has been substantial: 10,000 self-propelled guns were produced in 1972–86, with the 2S1, followed by the 2S3, the most numerous types. The 2S1 is also produced in Poland.

The ability of the artillery to suppress enemy weapons will largely determine the outcome of a Soviet offensive. Further, the artillery will often have to be self-propelled, this being the only available means of combining the mobility and supporting firepower that Soviet offensive tactics require. Self-propelled howitzers have also allowed the level of combined-arms integration to be lowered, which would be crucial in the mobile conditions the Soviets expect to predominate in any future war in Europe. Regiment, battalion and even company commanders can now have artillery support capable of staying with their tanks or BMPs and of entering action when and where needed to carry out the vital suppression mission. Their ability to operate close to the FEBA and the units they are supporting gives COPs and self-propelled howitzers their responsiveness.

SP howitzers have the survivability and mobility needed in a nuclear or conventional war. They can be attached – in batteries or even battalions – to manoeuvre battalions or units employed as part of a *reydy* or forward detachment. Instead of relying on the complex command, communications and co-ordination systems of US-style "on call" artillery support, the Soviets have achieved the same end by low-level integration. In mobile combat each battalion or regimental commander will have his artillery when and where he needs it, although, as with all Soviet artillery, it may prove impossible to "lend" it to a nearby unit.

Their armour and filtration systems reduce the vulnerability of SP howitzers to both conventional and NBC counterbattery fire. They can also move after firing, maintaining continuous fire as they go. Self-propelled howitzer batteries can be ready for action about two minutes after occupying a new firing position (three or four minutes at night), and time to move on is a fifth of that required for an artillery unit with the same calibre of towed weapon. When time permits, alternative firing positions will be prepared in advance, using engineer equipment if available.

Self-propelled howitzers will fight close to the enemy, usually 1000–3000m from the FEBA, or up to 4,000m when on the defensive. Indeed, the Soviets believe that there may be no stable FEBA in either conventional or NBC combat. Under such circumstances, concealment or, more often, rapid displacement will be the key to artillery survival. In addition, 2S3 units will be located further away from the FEBA to perform counterbattery missions.

When concealing themselves for sustained fire missions, SP howitzer batteries may deploy their guns over an area of up to 600 × 300m to take advantage of terrain and prevent multiple kills by enemy weapons. However, it appears likely that the traditional linear battery deployment will also be employed when rapid displacement is planned. The need for concealment is reduced in such cases, while a dispersed battery takes longer to move to another position than does one deployed in linear formation.

Whenever possible, several alternative firing positions, at least 200–300m apart, will be designated. If time permits, engineer equipment will dig firing pits and ammunition will be dumped at the firing positions. In order to avoid counterbattery fires, SP howitzer battalions will move after firing one or, at most, two missions normally lasting no more than five minutes.

Attacking or defending, SP howitzer units will if possible be part of co-ordinated fire plans, though in the Soviet view there will often be no time to prepare such plans. A Soviet battalion can launch a well co-ordinated "hasty" attack after 20–45min preparation; such an attack would not be delayed to allow additional artillery to be brought to bear. When the hasty attack is delivered straight from the line of march, there may be no artillery preparation at all except for direct fire by accompanying artillery. But normally SP artillery in direct support of a unit making a hasty attack will fire a 10–20min artillery offensive, using both direct and indirect fire if required. This might use up to 80% of the unit's on-vehicle ammunition.

Such an artillery offensive will include fire on headquarters and reserve positions, counterbattery fire against artillery that has opened fire, and, most important, suppression of enemy front-line weapons and forward

observers. The last type of fire will not lift until the attacking tanks are within 250m of the enemy position. Experience from both world wars has led the Soviets to believe that it will take at least three minutes for a defence to reorganise itself once artillery fire lifts, by which time, in theory at least, the defenders will have been overrun.

An important mission of Soviet SP howitzers is direct fire against enemy positions. Western SP howitzers, by contrast, use direct fire only as an emergency self-defence measure. These tactics relect the increasing Soviet trend towards "mobile firepower" and "manoeuvre by fire" and away from the massed barrages of the artillery offensive. The Soviets require artillery to be where it is needed without delay; if it is not, there may be no opportunity for it to come into action at all. One 2S1 battalion commander who used standard indirect fire when direct fire was possible was criticised for "overcomplicating" his tactics.

Though SP howitzers using direct fire risk heavy losses, these tactics will form part of a combined-arms assault. There will be many tanks, BMPs and APCs advancing between the howitzers and the enemy, so he will be unable to pick off the guns at his leisure. Besides, the losses sure to result from attacking unsuppressed defences, or from waiting for indirect fire, would far outweigh losses of SP howitzers used in this way.

Some Western analysts have heavily stressed the direct-fire role of SP howitzers, but the Soviets are well aware that these vehicles are not tanks or assault guns.

Unless an attacking force is able to suppress a defence fully it will suffer tremendous losses, particularly from ATGMs and artillery directed by forward observers. Direct-fire artillery can spot ATGM positions by their backblast and immediately open fire on them. Likely positions of forward observers and other priority targets will also be hit. The Soviets consider direct fire to be ten times as effective as indirect fire for suppression, and expect it to perform this task in less time, with fewer rounds and with higher kill probabilities than indirect fire. The howitzers are also much more effective against unarmoured targets than any tank gun.

Direct fire would also be directed at prepared defensive positions. The Soviets will normally try to outflank or envelop such positions and will not attempt a hasty attack unless assured of surprise or exceptionally powerful NBC or conventional fires.

In a breakthrough attack, SP howitzers will be brought forward, covered by artillery fire or darkness, and emplaced whenever possible in previously prepared firing pits. From their forward position, COPs can direct SP fire to knock out entrenched enemy weapons, especially ATGMs, during the artillery preparation. When prepared positions are not available, as would be the case in most hasty attacks, SP howitzers use covered positions and move frequently while employing direct fire.

Unless an attack is being made straight from the march, the SP howitzers will take up overwatch positions and open fire while the tanks, BMPs and APCs deploy for the attack. As these vehicles cross the line of departure, all of the SP howitzers will follow the attacking motorised rifle companies at a distance of only 500–1,000m, firing from the short halt. Alternatively, if there are enough SP howitzers available or the situation is favourable, some or all of them may remain in overwatch positions rather than advancing behind the assault. If time is of the essence, the SP howitzers may not fire a preparation at all but may instead move straight in behind the attack as "accompanying artillery", advancing across the line of departure 500–1,000m behind the leading motorised rifle companies and firing from the short halt. Again, ATGMs are the primary target.

Accompanying artillery also supports the advance through the depths of the defences, suppressing any strongpoints that could in turn be used to help consolidate captured positions and to defeat counterattacks. A defence similar to the one the Israelis encountered in Sinai in the first days of the 1973 war (relying on groups of unarmoured ATGM mounts) could suffer heavy losses from SP howitzer direct fire, their HE projectiles being much more powerful than any from a tank gun. However, accompanying artillery is by no means limited to or primarily tasked with direct fire. It must respond to all targets encountered by the tank or motorised rifle units to which it is attached. Tasks will thus include counterbattery fire, which the Soviets see as an important mission for accompanying artillery.

Self-propelled howitzer units will be used also for defensive fires, disrupting enemy assembly areas, firing counter-preparation missions, and laying down final protective fires for defending troops. Enemy tanks that penetrate the defence may also be engaged by direct fire, the artillery units forming part of the anti-armour backstop. Self-propelled howitzers would fight enemy armour from ambush whenever possible. If enemy tanks are reported in the area, two or three self-propelled howitzers may take up ambush positions while the remainder of the battery continues its mission.

Normally, regiment and division-level artillery will be attached down to battalions to act as accompanying artillery. The increase in army and front-level artillery makes is possible for more of these assets to be passed to low-level command. Whenever possible, each first-echelon attacking battalion has a minimum of a battery of accompanying artillery, and a battalion if possible.

2S3s operating near the FEBA could use AFAPs for quick-reaction nuclear strikes against enemy troops. The accuracy and small yield of such projectiles allow them to be used close to friendly troops and against mobile targets. Soviet sources suggest that the effective damage radius for such projectiles is about 100m against medium tanks and 300m against their crews.

Multiple rocket launchers: BM-21 122mm, BM-14 140mm, BM-24 240mm

Size	122mm	140mm	240mm
Designation	BM-21a	BM-14 (M-1965)	BM-24
Rockets mounted	40	16 or 17 (16)	12
Rocket length	1.905m (short) 3.23m (long)	1.092m	1.180m
Rocket weight	46kg (short) 77kg (long)	39.6kg	112.5kg
Warhead weight	19kg	18.8kg	46.9kg
Stabilisation	fin & spin	fin & spin	fin & spin
Rocket range	11km (short) 20.5km (long)	9.8km	11km
Max velocity	690m/sec	400m/sec	465m/sec
Reload time	10min	3–4min	3–4min
Rocket fuel	solid	solid	solid
Types of warhead	HE, I, chem, smoke	HE, chem, smoke	HE, chem (?), smoke (?)
Elevation limits	0°/+75°	0°/+45°	0°/+50°
Traverse	180°	210° (30°)	140°
Mounted on	Ural-375	ZIL-157 or -151 (2-wheel carriage)	ZIL-151 or -157
Launcher type	tubes	tubes	open frames
Total weight (firing)	13,300kg	6,432kg (1,200kg)	9,200kg
Length (travelling)	7.35m	6.92m	6.8m
Height (travelling)	2.85m	3.17m	3.0m
Width (travelling)	2.69m	2.3m	2.3m
Engine	V-8 petrol 175hp ZIL-375	6-in-line petrol 92hp ZIL-121	6-in-line petrol 92hp ZIL-121
Speed (max)	75km/h	60km/h	60km/h
Cruising range	750km	600km	600km
Trench	0.875m	0.69m	0.69m
Vertical obstacle	0.65m	0.46m	0.46m
Slope	30°	28°	28°
Ford	1.0m	0.8m	0.8m

Data in parentheses for towed M-1965 version of BM-14 used in airborne units.

BM-21b Grad-1 M-1976 36-tube version of BM-21. Mounted on ZIL-131 truck. Other data as for standard BM-21a.

BM-21v Grad-P M-1975 12-tube version of BM-21 mounted on GAZ-66 truck. 360° traverse; other data as for standard BM-21a.

Tactical data (BM-21a)

Unit of fire: 80 rounds

Normal distance behind FEBA: 5km (offensive and defensive).

Time to leave fire position (day/night): (battery) 3–5/6.5min; (battalion) 11/14min.

Time to move one kilometre (day/night): (battery and battalion) 3/3.5min.

Time to occupy fire positions (day/night); (battery) 10–12/18min; (battalion) 23/32min.

Effective fragmentation radius, one rocket (against APC/IFV/SP gun): 1.0/0.5/0.75m.

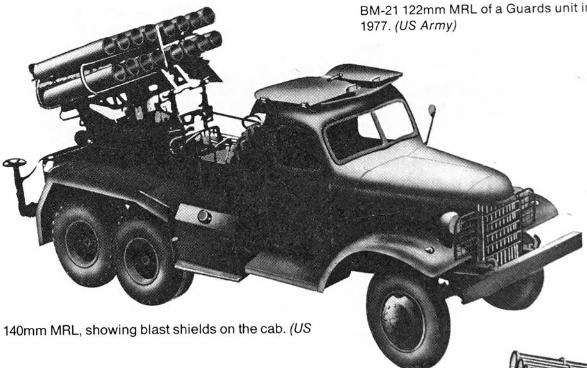
BM-21 accuracy: at two-thirds maximum range, probable error in range is 104m, in deflection 78m. At maximum range probable error is 168m in range, 80m in deflection.

BM-21 arming distance: 150–400m.

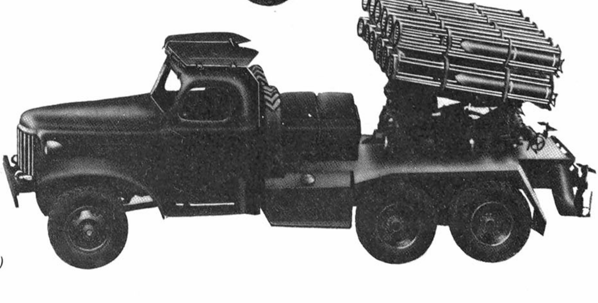
BM-14 (16-tube) accuracy: at two-thirds maximum range, probable error in range is 115m, probable error in deflection is 36m, and circular error probability is equivalent to 132m. At maximum range the probable error ranges are 85m and 30m respectively, with a CEP equivalent of 100m.

BM-24 accuracy: at two-thirds maximum range, probable error range is 61m in range and 46m in deflection, with a CEP equivalent of 93m. At maximum range, probable error ranges are 95m and 40m respectively, and CEP equivalent is 118m.

BM-21 122mm MRL of a Guards unit in Moscow, November 1977. *(US Army)*



BM-14 140mm MRL, showing blast shields on the cab. *(US Army)*



BM-24 240mm MRL. *(US Army)*

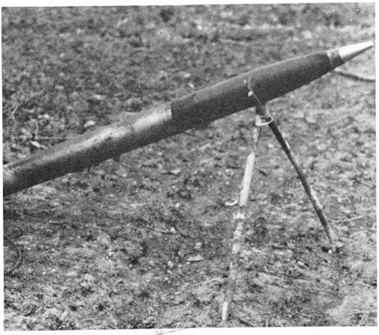
BM-21 122mm MRL battery in action.

The M-1975 12-tube 122mm MRL on a GAZ-66 truck—shown here in firing position with outriggers extended—has replaced most 140mm MRLs in airborne units. *(US Army)*

The Soviets define multiple rocket launchers (MRLs) as "collective fire systems; they serve to annihilate enemy personnel and fire weapons, combat vehicles and other material in concentration areas, as well as to neutralise artillery and mortar batteries. These shells are especially effective for repelling massed attacks and for fire assaults on major concentrations of enemy troops and material." The MRL fits well with Soviet tactics. It is an offensive weapon, able to create tremendous concentrations of mass firepower in a very short time. An MRL unit can project more firepower in a few seconds than 122mm howitzers could with a longer concentration. In artillery fire the first volley for effect is the most telling, as the enemy has not yet run for cover, so a volley of rockets can make the surprise effect even more deadly. MRLs are also highly mobile. The standard Soviet MRL, the 122mm BM-21, is mounted on a standard Ural-375 truck chassis, possible because it does not need the recoil mechanisms of tube artillery. MRLs are cheap and easy to produce, allowing them to be deployed *en masse*. A salvo-fire weapon, the MRL is less precise and simpler to use than tube artillery.

Although it falls within the definition of artillery, the Soviets view the MRL as a supplement to tube artillery rather than a substitute for it. The destructive potential of the MRL's massed, surprise concentrations is high, but its rate of fire is low (10min for a full reload) and the rockets are more expensive than shells.

Each tank and motorised rifle division has a BM-21a-



Individual 122mm rocket as used with the BM-21 in Vietnam. Soviet special forces, like the Vietnamese, use a light single tube. The rocket is the short version, with one section. The standard rocket has two sections.

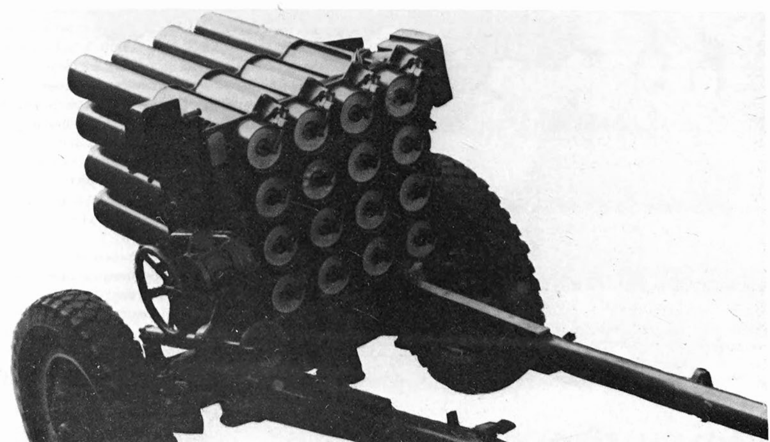
equipped MRL battalion, which is now part of the divisional artillery regiment. The BM-21 has also been used at army and front level, as part of separate MRL regiments or artillery divisions. It is being at least partially replaced by the BM-27 in this role. The BM-21 entered service in 1964 as a replacement for the 140mm BM-14. Although its rockets were smaller, they were longer-ranged and more powerful than the 140mm rockets. The 122mm rocket has a greater punch than the 122mm howitzer shell; without the need for a thick iron casing there can be more explosive. The rockets are two-section, solid-fuelled and stabilised by the "fin and spin" method. Spring-loaded fins pop up after launch and the rockets have a low rate of spin imparted by helical grooves in the launch tubes. The 122mm rocket system, nicknamed *Grad* ("hail") by the Soviets, can use either the longer, standard M-21-OF (9M22U) DB-1B rocket or the shorter, one-section, DKZ-B (9M28), the latter being the one normally used with single-tube man-portable launchers. The Grad-1 36-tube and M-1975 12-tube versions can use the shorter rocket. An improved-fragment version of the 9M22U is designated 9M22M (2.87m long, 66kg weight, 18kg warhead, 20,000m range). Long rockets have minimum ranges of 1,500m (indirect-fire) and 500m (direct-fire). Indirect-fire minimum ranges of the 9M28 and the 140mm rocket are 2,500m and 3,800m respectively.

Forty launch tubes in four rows of ten are mounted on a single turntable over the Ural-375's rear wheels. A 40-rocket salvo can be fired in a few seconds, or 40 rounds of ripple fire in under 30 seconds. Rockets can also be fired individually. A sight is mounted on a tubular extension on the right of the truck, folding down for use by a standing gunner. This along with the Ural-375's unprotected cab, limits the arc of fire of the BM-21 to 120° to the left and left rear, and 60° to the right.

To reduce reload time the Czechs have mounted the BM-21 on the large 10-ton Tatra-813 8 × 8 truck, positioning a reload pack of 40 rockets between the launcher and the armoured cab. They can be automatically loaded into the launcher when it is brought to zero elevation after firing, reducing reload time to two minutes. The East German Army also uses this system.

Grad-1 is reported to have been adopted by regimental MRL batteries. Corrugated sheet-metal fenders are

M-1965 140mm towed 16-tube MRL. *(US Army)*



attached to the side of the mount and traverse with it, unlike those of the BM-21a. Because it is mounted on the lighter ZIL-131 truck rather than the standard Ural-375, Grad-1 is apparently also used by divisional MRL battalions in motorised rifle divisions in Afghanistan and other areas where mobility in rough terrain in needed. The 12-tube M-1975 122mm MRL is mounted on a GAZ-66 truck. It is used by Guards airborne divisions, replacing the 16-tube towed 140mm MRL.

The 140mm BM-14 MRL series was introduced in 1959 and saw only brief service before being replaced by the BM-21. BM-14s mounted on ZIL-131 trucks were used in Asian military districts in 1980. The RPU-14 airborne version is still in Soviet service. The original 17-tube version of the BM-14 was mounted on a GAZ-63 truck. It was followed by a 16-tube version mounted on a ZIL-151 truck or ATS tractor. One 16-tube version, the RPU-14 M-1965, is being replaced by the 122mm M-1975, though it may still be used by the MRL battalions of Soviet airborne divisions. It is mounted like a gun on a simple, split-trail carriage and towed by a light truck. Reload time is four minutes. The Polish 6th Airborne Brigade uses an even lighter version, the eight-tube WP-8.

The 240mm BM-24, like the BM-14, has been withdrawn from frontline service, although it also remains in storage and possibly in low-readiness units. The wartime 132mm BM-13 and 1950s-vintage 250mm BM-25 MRLs both probably remain in use for training.

Combat usage

The BM-24 was the standard Arab MRL in the 1967 War, along with a number of BM-21s, and the Israelis captured most of both types. In 1973 the Arabs used the BM-21 as their standard MRL, and the Israelis also used battalions of Soviet-built MRLs that year. Israeli BM-24s fire an Israeli-designed rocket superior in performance to the Soviet ones. Today the MRLs, along with the M-46, are the only Soviet-built artillery in first-line Israeli units.

The North Vietnamese used single launch tubes taken from BM-14s and BM-21s. The 22kg tube could be mounted on a 28kg tripod, and both were normally manpacked. The "one-two-two rocket" was the most widely used North Vietnamese artillery weapon, and was frequently used against US forces, the attackers firing a few rounds and moving before the defenders could react.

BM-21s were used in Angola and in the Tanzania-Uganda War. In both cases the sound and fury of the BM-21 contributed greatly to its effectiveness. US troops in Vietnam were familiar with the noise of incoming rockets, but the same noise panicked hastily trained UNITA troops in Angola, and Ugandans and Libyans in Uganda. In both Angola and Uganda the BM-21s' area fire was inaccurate, but it was their moral rather than their physical effect that made them crucial.

In the Ogaden fighting Somali BM-14s initially panicked Ethiopian troops. The Soviet airlift, however, provided BM-21s and BMD-20s for the Ethiopians and their allies. MRLs have been extensively used in combat in Afghanistan.

Tactical employment

MRLs are used for massive surprise area HE concentrations and for putting down smoke and chemicals. BM-21as are not normally attached to regimental artillery groups or manoeuvre regiments or battalions. They are controlled by a divisional artillery group and used in the main attack sector. MRL units are frequently co-located with radio direction-finding equipment.

BM-21s are particularly suited to putting down concentrations of smoke and chemical ammunition, which they can deliver almost instantaneously, rather than in a slow-build-up by howitzers. This makes BM-21s especially effective when using deadly blood-agent chemicals, which require high concentrations to be effective and, if delivered quickly, will form a cooling cloud that retards dissipation. One BM-21 battalion salvo can create lethal concentrations of gas over an area greater than two square kilometres.

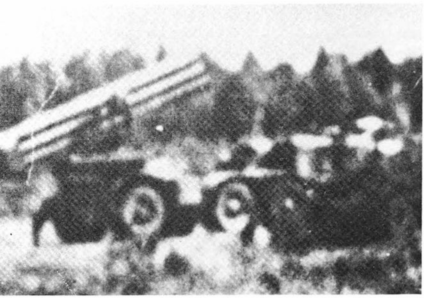
Although the Soviets see BM-21s primarily as offensive weapons because of their reload time, the rockets will be used in pre-planned final protective fires in the defensive, as well as for counterbattery work or to hit enemy assembly areas and headquarters.

The provision of Grad-1 MRLs at regimental level is significant in that it effectively makes each regiment a miniature division, with smaller versions of all the combat support units provided at division level. This makes regiments more capable of independent tactical action.

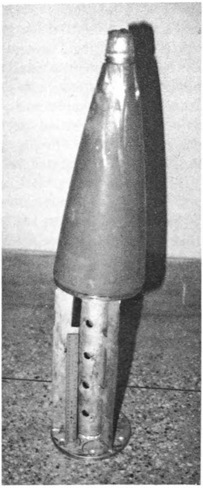
BM-27 M-1977 220mm multiple rocket launcher

Year introduced 1976–77 **Launch/resupply vehicle** ZIL-135-L9 8 × 8 truck **Length (travelling)** 9.7m (10.8m) **Width (travelling)** 2.8m (3.1m) **Height** 3.2m **Weight, with launcher** 22.75 tonnes **Road speed** 65km/h **Range** 500km **Rockets carried** 16 **Calibre of round** 220mm **Length of round** 4.8m **Weight of round** 360kg **Range** 40km **Warhead types** HE-Frag, chemical, submunitions (ICM and incendiary) **Time to fire salvo** 20sec **Tube pattern** 4 (top row) + 6 + 6 = 16 tubes **Firing elevation** +15°/+55° **Traverse (firing)** 240° **Emplacement time** 3–5min **Displacement time** 1–3min **Reload time** 15–20min **Deployment from FEBA** 8–15km

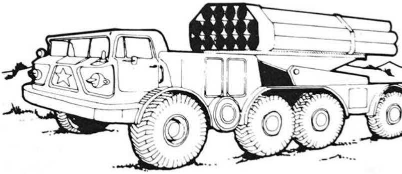
Figures in parentheses are for reload vehicle where it differs from launch vehicle.



Left The first open-source photograph of the BM-27 shows it in firing position with outriggers lowered and firing tubes elevated. The Afghan Resistance nicknames it the "Mushak", to distinguish it from the BM-21 "Beastoyek". *(US Army)*



Right Warhead of a 220mm minelet rocket fired from a BM-27 in Afghanistan. The mines are stacked in each quadrant of the round, which opens at a predetermined point in its trajectory. *(David C. Isby)*



Below BM-27 in travelling position. *(US Army)*

The BM-27 (nicknamed *Uragan*, Hurricane) is one of the new generation of heavy artillery weapons – along with the M-1976 towed and 2S5 self-propelled 152mm guns, 2S7 self-propelled 203mm gun and M-1976 self-propelled 240mm mortar – that allows the Soviets to strike deep at NATO tactical-level objectives. The BM-27 has a longer range than any of the other new weapons, making it a potential counter to the US-designed Multiple Launcher Rocket System (MLRS) now entering NATO service.

The 220mm rocket is an innovation in having submunition warheads in addition to the high-explosive and chemical-filled units used in previous Soviet artillery rockets. Fragmentation submunitions similar to those in US ICM (Improved Conventional Munition) rounds have been reported, as have minelets similar to those of the US ADM (Artillery Delivered Minelet) system. Its incendiary submunitions are the same as those of the 122mm rocket.

The ZIL-135 truck chassis is the basis for both the launch and the reload vehicles. Four stabilising jacks – one on each side, two at the rear – are used when firing. The reload vehicle's automatic power-loading device is a flatbed design, with the rockets mounted in two stacks on either side of the vehicle bed. The basic concept appears similar to that of the reload equipment used by the Czech Army on its Tatra-813 8 × 8 truck-mounted BM-21 122mm MRLs; the 220mm rockets are reloaded one at a time, however. The self-contained crane on the reload vehicle also allows for relatively rapid reloading.

BM-27s are organised into battalions consisting of one HQ, one support and three firing batteries. Each firing battery has six launchers and 12 resupply vehicles. These battalions are found in the MRL regiment or brigade of front-level artillery divisions and probably in the MRL regiment at army level as well, replacing BM-21s. The 34th Guards Artillery Division in East Germany is known to have a brigade of 72 BM-27s. They are not expected to replace the divisional or regimental BM-21s.

Combat usage

The BM-27 has seen combat in Afghanistan.

Tactical employment

The tactical use of the BM-27 has not been discussed in the Soviet open literature. It would however seem to be an excellent example of the "more and better" policy of weapons deployment. The BM-27 would be an excellent means of concentrating massed fire on key targets, and the large size of the rockets would allow a rapid build-up of lethal concentrations of chemical agents. The deployment of the BM-27 has to be viewed in the context of the continued Soviet emphasis on chemical weapons, and this may have influenced its design.

The introduction of the BM-27 in 1976–77 made sense in the light of the renewed emphasis on the use of operational manoeuvre groups and the organisation of front-level air assault and airmobile brigades. The support of forces intended to operate in the enemy's operational depths requires artillery that can also reach deep. That is why the new artillery of the 1970s fell largely into the heavy category. The BM-27, along with the tube artillery weapons that are also concentrated in non-divisional units, reduces the need for OMGs and air assault brigades to take artillery support with them in their penetrations. Even more important, the need to resupply such units is reduced.

Targets within 30km of the FLOT can be engaged with heavy artillery or by Hind assault helicopters. The Soviet Air Force will not normally use fixed-wing aircraft against targets that are within artillery range. The longer range of the BM-27 thus reduces the call on air support.

BM-27s will be used for fire strikes throughout the depths of the defence, one of the prerequisites of deep operations. Chemical delivery to suppress enemy weapons is also likely to be a primary mission. As with all Soviet MRLs, the BM-27 will also be used for counterbattery missions, usually co-located with the target-acquisition means.

280mm multiple rocket launcher

In the mid-1980s a Soviet 280mm MRL was in pre-series deployment. It is believed to be mounted on a large MAZ-type truck and to have a range of about 40km.

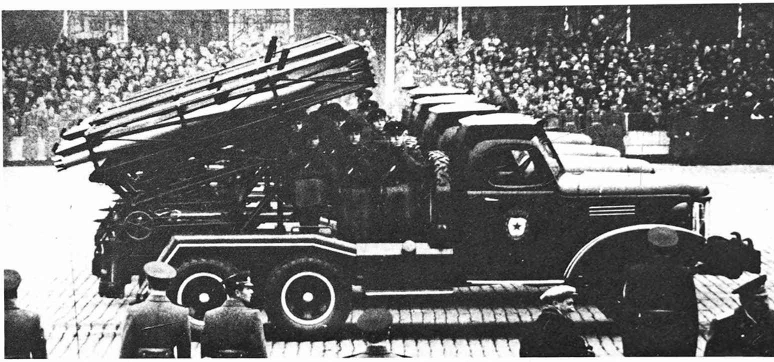
Obsolescent MRLs

BM-13 132mm MRL Number of rounds: 16; calibre: 132mm; length of round: 1.473m; weight of round: 42.5kg; max velocity: 350m/sec; max range: 9km; elevation: +15°/+45°; traverse: 20°; time to reload: 5–10min; crew: 6; chassis mounted on: ZIL-151/131 (postwar). The standard Soviet wartime "Katyusha", the BM-13 was used by units in Asia in 1980. The BM-13 is the standard MRL of the Afghan Army.

BMD-20 200mm MRL Number of rounds: 4; calibre: 200mm; length of round: 3.11m; weight of round: 194kg; weight of launch vehicle: 8,700kg; max range: 20km, elevation: +9°/+60°; traverse: 20°; time to reload: 6–10min; crew: 6; chassis mounted on ZIL-151 or 157. The long, finned, streamlined rockets are launched from an open-frame launcher with a spiral guide to impart spin. These weapons were supplied to Ethiopia in 1978.

BMD-25 250mm MRL Number of rounds: 6; calibre: 250mm; length of round: 5.822m; weight of round: 455kg; weight of launch vehicle: 18,145kg; max range: 30+km; elevation: 0°/+55°; traverse: 6°; chassis mounted on: KrAZ-214. The large frame-type launcher has two banks of three rails with spiral guide rails to impart spin. The

Wartime BM-13 132mm MRL mounted on a post-war ZIL-151 truck chassis. *(A. Dupouy)*



BMD-20 200mm multiple rocket launchers. *(US Army)*

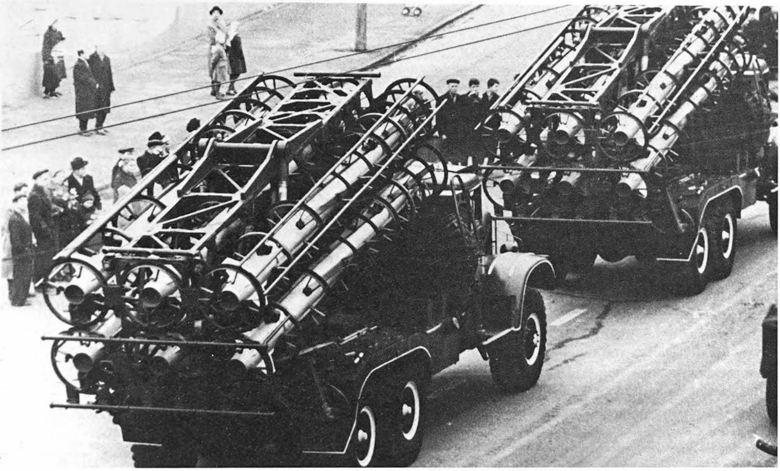
rockets are reportedly liquid-fuelled, the only MRL projectiles to be so propelled. The excessive size of the rocket is one of the reasons why this weapon has reportedly left service.

Foreign usage

D-30: Warsaw Pact armies, Afghanistan, Algeria, Angola, Benin, Chad, Congo, Cuba, Ethiopia, Finland, Guinea, Iraq, Libya, Madagascar, Mali, Mongolia, Morocco, Mozambique, Nicaragua, Nigeria (possibly no longer in service), North Korea, North Yemen, Peru, Somalia, South Yemen, Sudan, Syria, Tanzania (ex-Ugandan), Uganda, Vietnam, Yugoslavia, Zaïre, Zambia.
M-46: Warsaw Pact armies, Algeria, Angola, China, (Type 59-1, a modified version), Congo, Cuba, Egypt, Ethiopia, Finland, Guinea, Guinea-Bissau, India, Iran, Iraq, Israel, Libya, Mongolia, Morocco, Mozambique, Nigeria (probably no longer operational), North Korea, Pakistan (Chinese versions), Peru, Somalia, Sudan, Syria, Vietnam, Yugoslavia, Zaïre.
D-74: Warsaw Pact armies, China (produced as Type 60), Cuba, Egypt, Nigeria (?), Peru, Vietnam.
D-20: Afghanistan, Algeria, China (produced as Type 66), Cuba, Czechoslovakia, East Germany, Egypt, Ethiopia, Hungary, India, Nicaragua, Poland, Romania, Somalia, Vietnam, Yugoslavia.
D-1: Warsaw Pact armies (possibly not the Czechs), Afghanistan, Albania, China, Cuba, Egypt, Ethiopia, Iraq, Mongolia, Mozambique, Syria, Vietnam.
S-23: Egypt, India, Syria.
2S1: Algeria, Czechoslovakia, East Germany, Hungary, Iraq, Libya, Poland, Syria, Yugoslavia.
2S3: East Germany, Iraq, Libya.
BM-21: Warsaw Pact armies, Afghanistan, Algeria, Angola, Chad, Cuba, Egypt, Ethiopia, India, Iran, Iraq, Israel, Libya, Morocco, Mozambique, Nicaragua, North Korea, North Yemen, Pakistan, Tanzania, South Yemen, Syria, Vietnam, Zambia.
BM-14: Warsaw Pact armies (second-line use, possibly still first-line in some armies), Algeria, China, Egypt, Iraq, Israel, North Korea, Syria, Vietnam.
BM-24: may still be in second-line service in East Germany, North Korea and Poland; was also used by Algeria, Egypt, Israel and Syria.
M-30: All Warsaw Pact armies (mostly second-line, but may be first-line equipment in low-readiness units), Algeria, China (produced as Type 54 and used on the Chinese 122mm SP gun), Cuba, Egypt, Iraq, Lebanon, Libya, Nicaragua, North Korea, Syria, Vietnam, Yugoslavia.
A-19: Warsaw Pact armies (all second-line), Albania, Algeria, China, Cuba, Egypt, Finland, Germany (WW2), Guinea, Indonesia, Iraq, Kampuchea, North Korea, North Yemen, Somalia, South Yemen, Spain (captured examples), Syria, Tanzania, Yugoslavia, Zaïre. This weapon was supplied to all these nations but, like the M-30 and the ML-20, it is probably no longer in service with many of them.
ML-20: Warsaw Pact armies (in second-line roles, possibly not in East Germany), Albania, Algeria, China, Cuba,

Egypt, Iraq, North Korea, Syria, Vietnam, Yugoslavia.
M-1937: Warsaw Pact armies, China, Cuba, Vietnam and many other nations.
M-1938 and M-1943: Warsaw Pact armies, Albania, Algeria, Austria (designated M-60), China, Congo, Egypt, Iraq, Lebanon, Morocco, North Korea, Pakistan, Syria, Tanzania, Vietnam, Yemen, Yugoslavia and others.
M-1953: China (Type 60), Egypt, India (?), Syria.
M-1952 (240mm): as supplied to Algeria, Bulgaria, China, Hungary, India, Iraq, Romania, Syria and others; numbers in service unknown.

BMD-25 250mm multiple rocket launchers. *(US Army)*



Chapter Twelve

Nuclear, biological and chemical (NBC) weapons

"Nuclear weapons are the basic means of destruction on the field of battle."

COL V. YE. SAVKIN

Nuclear operations

Soviet warfare is basically nuclear warfare. The great task of post-war Soviet doctrine has been to come to grips with military operations in an environment dominated, if not by actual nuclear weapons, then with the threat of their use at any time. Unlike the US Army, the Soviet Army does not see nuclear-environment tactics as something external and additional to their normal means of operation: they *are* its normal means of operation.

This conviction has not been altered by the 1981 no-first-use declaration and the improvement in conventional warfighting capability. Despite recent changes, Soviet operational and tactical thought remains valid for both the conventional and nuclear environments. In Soviet eyes, any tendency to become less capable of operating in a nuclear environment is counterproductive in the extreme. Thus the build-up of the Soviet theatre nuclear threat in the 1970s – exemplified by the SS-20 Sabre IRBM and Tu-26 Backfire bomber – represented a fundamental change in the balance of power in Europe.

The initial decision to use nuclear weapons must be made at the highest level of the Soviet government. Once the decision to use them is made, their use and delivery will be controlled at front level, even though nuclear-capable weapons are organic to army and division levels. Nuclear weapons control is rarely delegated, although there are signs that this may be changing.

The Soviet Army's nuclear capability had greatly increased by the mid-1980s. Despite the December 1987 treaty, the Soviets still have enough theatre and tactical nuclear delivery systems to meet their armament norms. Army nuclear delivery is now much more effective than it was in the FROG and Scud era. On the battlefield itself, the new nuclear-capable artillery and improved chemical weapons are much more flexible in their use than the relatively inaccurate systems designed for the massive pre-emptive nuclear strikes envisaged by 1960s-vintage doctrine.

Submarine-launched cruise and ballistic missiles could be used against all but the few (estimated 20) hard targets in NATO, these being potential SS-19 ballistic missile targets. In the 1970s Tu-26 Backfires and Su-24 Fencers with greater penetration capability were introduced in significant numbers. The increased lethality of conventional weapons has made it unlikely that NATO's nuclear delivery aircraft could ride out an initial strike even at their hardened main operating bases. Thus the Soviet theatre nuclear threat has evolved from a bludgeon into, if not a rapier, at least a cutlass.

The Soviets believe that any future war will probably begin with a conventional phase. While open Soviet literature appears to shun the initial use of chemical warfare, their intense chemical warfare effort belies this claim. Reverses in battle or a slowing down of the offensive will probably result in the use of chemical weapons. The nuclear threshold is a more dangerous one. The Soviets are well aware that a theatre-level nuclear exchange could escalate into a strategic conflagration, but it seems possible that the Soviets may use nuclear weapons to restore mobile warfare if they have been halted or fear a battle of attrition. It is almost certain that they would use nuclear weapons if they thought an enemy was likely to use them first. They believe that the "agressive forces of monopoly capitalism, if desperate, may well carry out their oftstated threat to initiate nuclear destruction." The Soviets have a great fear of being pre-empted. Nuclear weapons are however still capable of making any victory gained by the rest of the Soviet armed forces a pyrrhic one.

Once the Soviets have decided to use nuclear weapons, they will use them in a manner intended to assure full surprise and shock effect. The Soviets view the controlled, limited use of theatre nuclear weapons, once the theatre nuclear threshold has been crossed, as a nonsense. A scenario in which the Soviets might destroy one city with one missile to cross the nuclear threshold is ridiculous.

Just as they are convinced that surprise pays dividends,

the Soviets are convinced that restraint is foolhardy, especially when dealing with nuclear weapons, and any idea of limited theatre nuclear operations is seen as a foolish Western concept. As one Soviet military writer has put it, "any delay in the destruction of enemy nuclear attack means will permit the enemy to launch nuclear strikes first, and may lead to heavy losses and even to the defeat of the offensive." The aim of all war and all weapons is victory, a victory which, from a Marxist-Leninist

Below The Soviet Army's offensive NBC capability is matched by an impressive range of defensive systems. Here a T-64A tank is decontaminated next to a GAZ-66 box-body van fitted with sprinkling arms. *(US Department of Defence)*

viewpoint, must inevitably mean the collapse of capitalism and the triumph of global socialism.

If the Soviets go nuclear, the first strike will aim at nothing less than the destruction of all nuclear means of retaliation. It is however possible that some form of a graduated or selective release would be considered. The public emphasis on an initial strike may contribute to deterrence, but there may well be benefits in retaining assets for prolonged operations.

Next in priority are headquarters and communications facilities, reserves, known defensive positions, and rear-area installations including airfields and ports. In addition, the increased emphasis on conventional warfighting has resulted in a requirement to be able to knock out these same objectives with a variety of non-nuclear means: aircraft (especially when used in conjunction with other forces as part of the air operation), surface-to-surface missiles, vertical envelopment forces, special forces, and deep-striking ground units.

The Soviet initial strike will be large, with up to a third of all available warheads being used if delivery systems are available, and the remainder being used in follow-up strikes over the next several days. Soviet tactical nuclear weapons have traditionally been large and relatively dirty devices, using airburst detonation. They make up in size for lack of accuracy. This inaccuracy determined much of the blanket-like strike planning of previous years. Today there are signs that Soviet theatre nuclear tactics are becoming more flexible and selective, although not limited in scope. This is made possible by more accurate delivery systems: missiles, aircraft and, especially, the new nuclear-capable artillery. Not only can these weapons deliver the warheads where they are needed, but when they are needed because response time has been lowered. This makes the use of lower-yield devices practical, as up-to-date target intelligence can be used and the large blast radius of earlier weapons is not needed to catch an enemy who may have moved. The Soviets have an interest in minimising collateral damage. They do not wish to advance across a radioactive wasteland if they can avoid it, nor would they wish to control one after the war.

The influence of nuclear weapons can be seen throughout Soviet operations and tactics. There is hardly an element that is not in some way attributable to nuclear weapons. The increased emphasis on surprise, speed and mobility are counters to the potentially devastating effect of even a few nuclear weapons. Target acquisition for nuclear weapons is one of the prime missions of all the forward detachments, *reydy*, long-range reconnaissance patrols and *desants* that have increased in importance in recent years. The build-up of helicopter forces gives a follow-up capability to nuclear strikes. These are just a few of the ways in which Soviet military developments are responses to the requirements of the nuclear battlefield.

In actual use nuclear weapons supplement rather than replace conventional fires. They are not a substitute for normal weapons or tactics. Strikes against enemy frontline troops will be made as close as safety permits, as the Soviets will only rarely withdraw troops to create a safety margin. Usually only one warhead is used against each target.

Soviet nuclear storage sites are separate from the delivery systems and heavily guarded by the KGB troops. The warheads are moved to the delivery systems in closed vans as part of small, heavily guarded convoys, often with light aircraft overhead to maintain communications. Alternatively, warheads may be delivered by helicopters with a close escort of gunships and a top cover of fighters.

Rocket and missile launch sites with their attendant radar and support vehicles will be camouflaged. Tube artillery will usually register in against a target using conventional ammunition before firing nuclear rounds. Conventional-warhead rockets or missiles may also be used in this manner. While front-line troops will not usually withdraw when a nuclear strike is planned, they may dig in or, if possible, cover their own positions with smoke against the thermal effects of the blast.

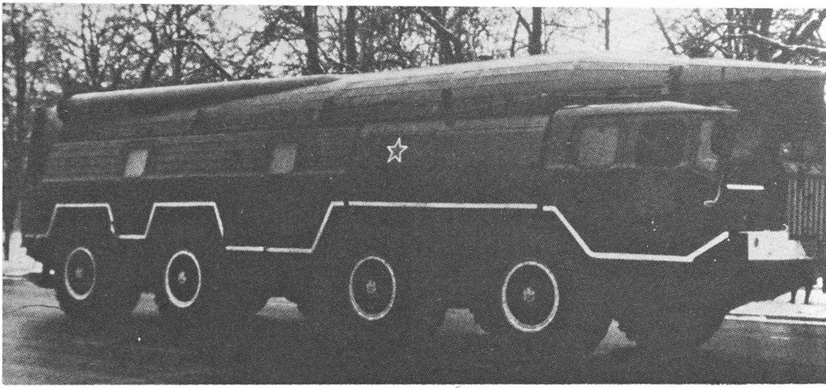
In NBC conditions each Soviet unit and formation will have a mobile reserve force capable of shifting laterally into any neighbouring sector hit by an NBC strike in order to prevent rapid enemy exploitation and assist in reconstitution.

The conventional capabilities of the SS-23 and SS-12 Mod could be the hardest to replace. Accurate conventionally armed surface-to-surface missiles could form a valuable element of Soviet deep-strike operations, their quick reaction time and concentrated firepower outweighing their high unit cost. The SS-21 gives commanders at division level the ability to strike directly at the operational depths of the enemy defences. They can strike the same targets as conventionally armed fighter-bombers, but with a number of advantages: they cannot be shot down by fighters or SAMs, and they are much less vulnerable to air strikes than are fixed-wing aircraft, tied to a limited number of main and dispersed operating bases.

This capability allows the Soviet Army to play an important part in the air operation of the TVD offensive. SSMs can be used against SAM sites and airfields, which would otherwise absorb a high percentage of the available sorties.

The new SSMs also allow nuclear weapons to be used more effectively. In addition to their greater accuracy, their mobility makes them more capable of surviving than nuclear-capable aircraft. They are more precise systems, capable of improving on the massive "spasm" attacks of earlier weapons while still being available for such use if required.

They also offer an improved chemical warfare capability. While older Soviet systems certainly had a chemical capability, the new systems' increased accuracy means



SS-12 Scaleboard missile on its transporter. *(US Army)*

that a barrage-style attack is not required to cover a target. A single attack with chemical weapons on an air base could halve the sortie rate, according to USAF testimony.

That the Soviets are aware of the potential of the tactical ballistic missile is indicated by their deployment of the SA-12 Giant, designed to intercept such missiles. If this can eventually be made to work fully – emerging technologies offer no guarantees, particularly when they are Soviet – NATO would find itself at a major disadvantage.

The increased emphasis on the fighting of the theatre-level operation by the TVD high command makes it likely that at the start of a conflict SSM use would be planned at that level. While a TVD high command might have even Strategic Rocket Forces missiles placed under its command for an operation, the political leadership would determine the weight of strikes. The concept of norms requires complete coverage to destroy the most threatening forces and key links and nodes, at the same time retaining a large reserve.

Weapons effectiveness

The Soviets consider that a dozen 10kT nuclear warheads are required to put an enemy division out of action. Blast effect creates tremendous overpressure, destroying buildings, trees, vehicles, aircraft and anything else within its radius. Thermal effects follow the blast. The intense heat of the explosion will set fire to anything that can possibly burn, and the debris created by the blast a fraction of an instant before makes good kindling. Thermal effects will also burn exposed skin. Dazzle caused by the blinding effect of a nuclear explosion can put large numbers of troops temporarily out of action, especially at night. Radiation is the biggest killer, although troops in entrenchments and armoured vehicles or wearing NBC suits have a degree of protection. Radiation also has a residual effect in contaminated areas, and equipment exposed to radioactivity becomes radioactive itself until decontaminated. Electromagnetic pulse (EMP) emanating from a nuclear burst can damage radios, radars and all electronic equipment, although most military electronics are "hardened" against EMP. A communications blackout can endure after the blast, the disturbance in the atmosphere disrupting radio links. Fallout can produce casualties, delay movements and deny terrain.

Unit organisation

FROG/SS-21 battalion (tank and motorised rifle division)
Total strength: 18 officers, 138 enlisted men.

One HQ battery (eight officers, 66 enlisted men, 34 trucks, one BRDM, one BTR-60, 23 jeeps)
Two FROG/SS-21 batteries (each of five officers, 36 enlisted men, two FROG/SS-21 launchers, two FROG/SS-21 reload carriers [3 missiles each], one truck with an End Tray radar, one truck with a Bread Bin radar).
In wartime the number of launch vehicles per FROG-7 or SS-21-equipped battalion could increase from four to six. Each battery consists of two firing sections, a meteorological section and a survey section. There may be as many as seven FROG or six SS-21 rounds per launch vehicle held by division: one on the launch vehicle, two or three on the reload vehicle, and three on trailers.

SS-23/Scud or SS-22/Scaleboard brigade or independent battalion (front or army)
Total strength: 178 officers, 1,083 enlisted men.
One HQ battery (20 officers, 125 enlisted men, 75 jeeps and trucks)
Three launcher battalions (each of 43 officers, 325 enlisted men, 4–6 launch and reload vehicles [six only in some SS-23 brigades], 10 trucks, possibly including additional reload vehicles) (independent battalions similar)
One signals company (seven officers, 70 enlisted men, 20 jeeps and trucks)
One engineer company (seven officers, 78 enlisted men, 15 cranes, 26 trucks, 15 BAT dozers, 5 MDK-2 ditching machines)
Technical support and services (15 officers, 135 enlisted men, 47 trucks, three End Tray radars)

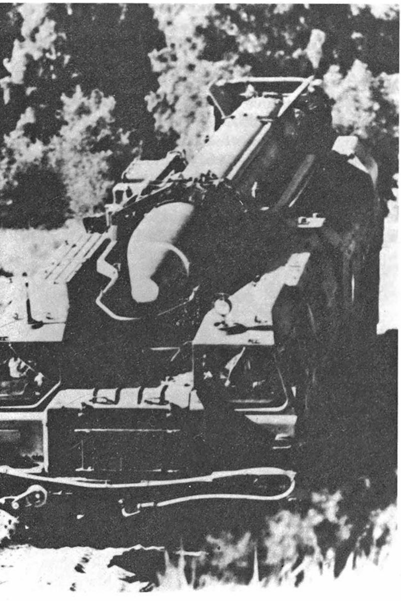
Surface-to-surface missiles

Missile	FROG-7	Scud-B	Scaleboard
Missile length	9.1m	11.4m	11.25m
Missile weight	2,300kg	6,370kg	8,800kg
Warhead weight	550kg	1,000kg	unknown
Warhead yield	25–40kT	40–100kT	1MT
Missile diameter	0.55m	0.84m	1.05m
Fuel	solid	liquid	liquid
Guidance	none	inertial	inertial
Control	speed brakes	efflux vanes	vanes or fins
Max range	60–70km	280km	700-800km
Min range	11–12km	unknown	unknown
Time to fire	20–30min	1–1.5hr	2–4 hours
Warheads	nuclear, HE, chem	nuclear, HE, chem	nuclear
Stages	1	1	2
Crew	4	4–6	6 +
CEP	0.5–0.7km	1km	0.6 + km
Level of use	division	army	front
Launch vehicle	ZIL-135	MAZ-543	MAZ-543
Radars	End Tray	End Tray	End Tray
Year introduced	1965	1965	1965–7

Missile	SS-21	SS-12 Mod/SS-22	SS-23
Soviet name	*Tochka* ("Point")	OTR-22	OTR-23
NATO codename	Spider	Scaleboard Mod 2	Scarab
Missile length	9.44m	12.38m	7.52m
Missile weight	2,700kg	8,800kg	3,990kg
Warhead weight	700kg	1,000kg	700kg
Warhead yields	10kT, 100kT	10kT, 20kT, 100kT, 500kT	10kT, 20kT, 100kT, 500kT
Missile diameter	0.46m	0.85m	0.97m
Fuel	solid	solid	solid
Guidance	inertial	inertial	inertial
Max range	120km	900km	500km
Min range	14km	–	–
Time to fire	15min	15min	15min
Warheads	1	1	1
Stages	1	2	1
CEP	300m	370m	300–370m
Level of use	division	TVD	army
Launch vehicle	MAZ-5937	MAZ-7310	MAZ
Year introduced	1976	1977	1980
Numbers in Western TVD (1985/87)	375/550	80/98	15/145
Replaces	FROG-7	Scaleboard	Scud
Refire time	65–70min	60min	30–60min
Annual production	200	10	200

Above FROG-7 (Soviet nickname *Luna*-M) mounted on its ZIL-135 transporter. *(US Army)*

Below Scud-B launch vehicle in travelling position. The Soviet nickname for this system is "Sperm Whale," a reference to its large size. *(US Department of Defence)*



While they are now ageing, the FROG-7 rocket and Scud-B and Scaleboard SSMs still remain a significant part of the Soviet Army's nuclear delivery capability. They are being replaced by the SS-21, SS-23 and SS-12 Mod/SS-22 respectively. These new weapons, used in largely the same way, offer new capabilities and increased accuracy for theatre nuclear warfare and the use of chemical and conventional warheads. The SS-23 and SS-12 Mod 2 forces are to be scrapped under the terms of the December 1987 INF Treaty.

The FROG-7 is the latest in a series of unguided tactical nuclear-capable rockets (FROG = Free Rocket Over Ground). Other earlier FROGs have been exported and still remain in Soviet service for training and in some low-readiness units. The FROG-7 is mounted on an eight-wheeled ZIL-135 truck with its own crane. This vehicle was reportedly selected, like the Scud-B launch vehicle, because it offered much greater reliability over the tank chassis which it replaced, and its cross-country mobility was good. A similar reload vehicle carries three extra rockets. The FROG-7 is aimed by adjusting elevation and setting speed brakes. The Bread Bin and End Tray radars are used for determining meteorological factors that might affect the FROG's flight. End Tray is used with FROG-7, Bread Bin with earlier FROGs. The ZIL-135's good cross-country mobility comes into its own after firing. FROG-7s are kept well forward: 8–18km from the line of contact in the offensive, 25–50% further on the defensive. FROGs are used against tactical targets.

The Scud-B replaces the earlier Scud-A, which was mounted on an IS-2 tank chassis. Designated R-11 and R-150 in Soviet service, Scud-A became operational in 1955–56 and is now probably gone from the inventory,

Scud-B having taken over even for target purposes. Introduced in 1960–61, the SS-1c Scud-B (Soviet designation R-17 and R-300) with its improved inertial guidance system was initially mounted on the unreliable IS-2 and then, from 1965, on the eight-wheeled MAZ-543P. At least four MAZ-543P versions were used during the 620-vehicle production run. An export version of Scud-B, designated R-17E, was also deployed. It was supplied to non-Warsaw Pact nations and has a manual command and control interface instead of the improved Soviet fire-control system.

Like the larger Scaleboard, the Scud-B uses liquid fuel, apparently of a type that is storable and does not require preheating. Guidance is by an inertial system. An interim version of the Scud-B retains the fuel tank arrangement of the Scud-A, and its range is also probably closer to that of the earlier missile. Scud will be used against targets in the enemy rear areas: airfields, headquarters and lines of communication.

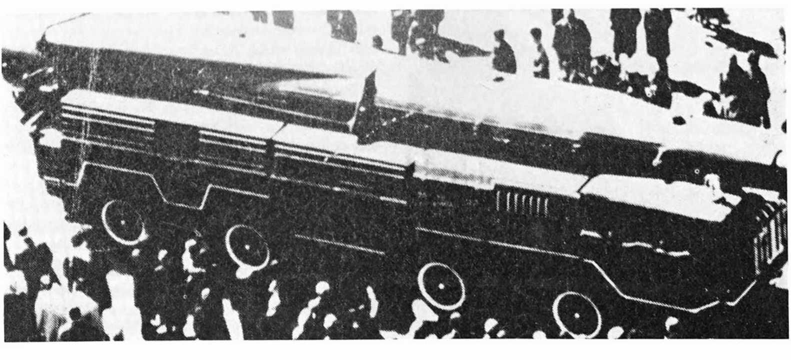
In the late 1960s there emerged an improved Scud-B, known as Scud-C or KY-3 (for Kasputin Yar, where it was seen being tested). This had a maximum range of 550km and a refire time of about 60min, compared with about 160min for earlier Scuds. Production total is uncertain: possibly as few as 20–30, possibly more.

Scud-C is less accurate than Scud-B, with a CEP of 1.3km. Its throw weight is also less (600kg compared to 1,000kg) because it has an ICBM-style separating warhead compared with Scud-B's non-separating warhead, typical of smaller SSMs. Scud-D, developed in the 1980s, is reported to have an improved guidance system that increases accuracy and permits the use of a range of conventional warheads – including submunition and minelet payloads – in addition to the standard nuclear and chemical warheads. Total Soviet Scud strength was 620 launch vehicles in 1986. In 1987 over 500 were reported to be opposite NATO, over 100 in the Far East TVD, about 75 in the Southern TVD and over 25 in strategic reserve. They will probably remain in service through the 1990s.

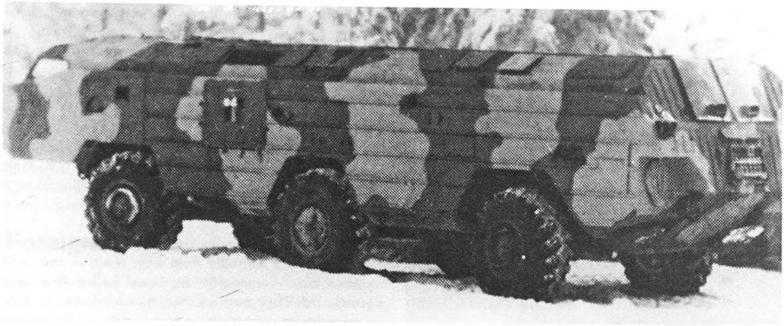
Scud brigades have expanded from nine launchers in the 1960s to 12 in the 1970s and, following the upgrading of Soviet SSM forces in the early 1980s and the introduction of the SS-23, to 18 at least in brigades in Eastern Europe. The latter have three battalions, each with three two-launcher batteries. Each battery also has a reload vehicle for each launcher, a GAZ-66 van as a fire-control centre, a ZIL-133 maintenance van, and communications vehicles, either BTRs or ZIL vans. It has been reported that each SSM brigade has a KGB detachment for warhead security.

The SS-12 Scaleboard was the Soviet Army's largest missile. Like the Scud-B, it was carried on a MAZ-543 and used with the End Tray meteorological radar. Its range gave it the capability to strike targets throughout Western Europe, and its mobility made target acquisition difficult unless it was spotted as it was being prepared to fire. The two-stage liquid-fuel Scaleboard had a separating warhead section. Starting in 1978, four brigades of Scaleboards were deployed in East Germany and Czechoslovakia. By 1987 all Soviet (non-export) SS-12s had been replaced by SS-12 Mods.

The SS-21 first entered service in 1976 after tests in the early 1970s. The first deliveries to Soviet divisions in East Germany came in 1981. Initial numbers delivered were limited, leading to slow replacement of FROG-7s. Only about 220 SS-21 launch vehicles had been produced by mid-1985, increasing to about 300 by early 1987. In mid-1986 the Czech Army received its first batch of 40, at which time it was likely that all of the Soviet divisions in



SS-12 Mod/SS-22 on its launch vehicle. The launch vehicle differs from that of the SS-12 in having exhaust gills behind the cab. *(US Army)*



SS-21 launch vehicle with missile retracted into its bay to protect it from the elements. The vehicle's resemblance to the SA-8 unit is apparent. Some estimates of SS-21 strength are half those given here. *(US Department of Defence)*

Group of Soviet Forces Germany and Central Group of Forces were equipped with SS-21s. Half of GSFG was still FROG-7-equipped as recently as March 1984, however, and two divisions had FROG-7s up to 1985. SS-21s, using sub-munition conventional warheads, are reported to have been used in action in Afghanistan by 1986.

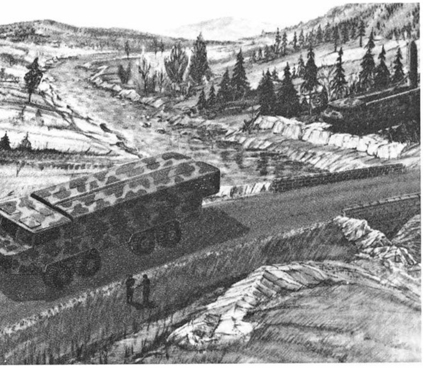
The SS-21's launch vehicle seems similar to that of the SA-8, and shares its amphibious capability and NBC defence and filtration system. The missile is on an elevating launch rail that retracts into the vehicle and is covered by metal doors when not in the firing position, reducing the chances of damage. The missile probably elevates to a vertical position to fire; it retains the non-separating warhead of the FROG series. Each SS-21 firing vehicle is accompanied by a reload vehicle carrying two rounds, compared with three for FROG-7; this may increase as more SS-21s become available. In addition to nuclear, chemical, unitary HE, HEAT and HE-Frag cluster warheads, the SS-21 is reported to have a specialised anti-airfield warhead, possibly carrying rocket-assisted "concrete-dibber" sub-munitions.

The SS-12 Scaleboard Mod 2 – previously known as the SS-22 and, before that, the KY-11 – was a much improved replacement for the SS-12 (a maximum of about 120 of which were in service). Combining the earlier model's 900km range and separating-warhead two-stage design with better guidance systems, it had completely replaced the original SS-12 by 1987. Reliability, estimated at 80% for the weapons system in the SS-12, increased by 5% in the SS-12 Mod 2, which started trials in 1973. The missile entered service in 1977–79 and the first combat brigade was operational in 1984. In 1987, 84 launchers were forward-deployed in East Germany and Czechoslovakia. While the SS-12 Mod 2/SS-22 was mounted in the same way as the SS-12, it was on an improved MAZ-7310 launch vehicle. The missile itself was probably designed by the Nadirazde bureau at Biysk and built at the Votkinsk Machine Building Plant. In 1987 there were 726 live and 185 training missiles and 135 launch and 62 transport vehicles in service, combat units holding two missiles per launch vehicle.

The SS-23 Scarab was intended to be a longer-ranged replacement for Scud. The brigades in the USSR and East Germany were both operational by 1985 (the first Soviet deployment probably being in 1980–82) and by late 1987 167 live and 54 training missiles and 82 launch and 76 transporter vehicles were in service. Combat units hold two missiles per launch vehicle. Compared with Scud, it offers improved range (which led to its falling under the terms of the 1987 treaty), accuracy and reaction time. In addition to nuclear and chemical warheads, it can carry a range of conventional warheads, including sub-munition types. Like Scaleboard Mod 2, it was built at Votkinsk. The vehicle is a large MAZ truck. The missile is covered during movement and elevates to the vertical to fire.

The destruction of all SS-12 Mod 2s and SS-23s by 1990 under the terms of the treaty does not alter the continued primacy of nuclear weapons in the Soviet view of modern warfighting. Scuds, aircraft, and naval cruise and ballistic missiles can carry out their nuclear missions – NATO has few hardened targets requiring high nuclear accuracy (about 20, France apart) – but their long-range accurate conventional strike capability will be harder to replace.

In 1987 there were about 500 FROG/SS-21 launch vehicles opposite NATO, 215 in the Far East TVD, 100 in the Southern TVD and 75 in strategic reserve. FROGs and Scuds were used in the 1973 Middle East war. They did not prove effective. Egyptian FROGs were used against Israeli bases and airfields in Sinai, but do not appear to have done



Artist's impression of an SS-23 launch vehicle. *(US Department of Defence)*

much damage. Later they were used against the Israeli bridgehead across the Suez Canal, but again with little effect. At least one FROG hit an Israeli air base, possibly destroying an aircraft. The Israelis claim that at least one Egyptian FROG was shot down by air-defence weapons. The Egyptians used modern FROG-7s, as well as earlier versions, but the Syrians apparently had only FROG-2s and FROG-3s. The inaccuracy of these weapons resulted in their impacting throughout Galilee when aimed at Israeli bases. The Israelis, however, interpreted these FROGs as being aimed at *kibbutzim* and retaliated.

In 1973 the Syrians kept their FROG-7s deployed in an area 12–15km behind the front line, possibly in tunnels. To extend their range they would move up to pre-surveyed positions within 3km of the front line, remaining only long enough to fire and then displacing. Starting in 1985, the Soviets have used conventionally armed FROG-7s in Afghanistan. Armed with sub-munition warheads, they have been used against villages as part of the campaign against agriculture.

The Egyptians fired three Scud-Bs in the last days of the war, two against the Israeli bridgehead and one against a target in Sinai. None hit anything of value. In addition to the Egyptian Scud-B unit, a Soviet nuclear-capable Scud-B brigade was reportedly airlifted into Egypt during the war (without its nuclear warheads, which were sent separately by ship).

About a dozen Scaleboards are said to have been supplied to Iraq, although they have not been used in combat. The Iraqis are the biggest combat users of Scud, having by early 1987 fired 70–150 examples at cities, oil facilities and ports. Iran fired over three dozen Scud-Bs at Baghdad in 1985–87; none impacted within 300m of the apparent target. The Iranians are reported to have obtained further supplies from the Soviet Union and North Korea. Libya purchased 72 Scud launch vehicles and 300 missiles. At least 30 of the missiles are believed to have been transferred to Iran. Two Libyan Scud-Bs were fired at the Italian island of Lampedusa in April 1986, falling short of their targets. Scuds were used in the attempted coup in South Yemen in 1986.

The 1973 War emphasised the drawbacks of these weapons. They all suffer from long reaction and preparation times, especially the liquid-fuelled Scud and Scaleboard. Their poor accuracy is compounded by using a primitive manual interface with command control and targeting means, rather than computers and automatic data links. This allows human errors to compound those inherent in the system. Specialised fire-control computer vehicles have not been reported in these units, but their provision is expected in the near future. They are reportedly vulnerable to aircraft and air-defence weapons in flight. Reliability is poor: the US Army estimates a 10–20% dud rate in nuclear-armed rockets.

Some sources use the designation FROG-7B for a version with a 436kg (216kg of TVX) chemical warhead and with its minimum range increased to 14km.

While there is no hard evidence that the Soviets have developed or are developing such a capability, the Soviet press has made a number of references to direct-fire nuclear weapons, or to the use of nuclear weapons from helicopters. The material in Soviet sources seems to view this as feasible with sub-kiloton warheads – a 0.02kT warhead would have an effective damage radius of 25m against tanks and 130m against their crews, compared to 120m and 340m respectively for a 0.5kT device and 450m and 800m for a 20kT device. (Other damage radii are: 10kT, 350m/700m; 50kT, 600m/900m; 100kT, 800m/1,100m; 150kT, 1,000m/1,300m; 500kT, 1,700/1,700m.) With the new capabilities of the 152mm tube artillery nuclear round and those of Soviet missiles, such use of nuclear weapons cannot be ruled out. The small damage radii would allow Soviet forces to use these weapons at comparatively short ranges without running an excessive risk.

Older surface-to-surface missiles

The Soviet Army was still using the FROG-3 in 1979, despite its age, and other Soviet missiles of similar vintage may also be soldiering on. The Scunner, a copy of the V-2, served briefly in the 1950s.

FROG-3, 4 Launch vehicle: modified PT-76 chassis, not

amphibious; weight: 2,266kg; length: 10.55m; diameter: 0.4m; warhead weight: 454kg; range: 35km; warhead yield: 25kT. FROG-3, FROG-5 and FROG-4 differ only in the physical appearance of the warheads (the FROG-3 warhead is short and fat, the FROG-4 and FROG-5 warhead longer and thinner). The FROG-6 is a non-operational training version.

Scud-A Launch vehicle: IS-III chassis; length: 10.7m; diameter: 0.85m; launch weight: 4,400kg; range: 130km. Other data similar to Scud-B.

Foreign use

The Soviets have exported NBC defence equipment to their Warsaw Pact allies, Cuba and Vietnam, although many of these nations produce their own equivalents.

Early FROGs were supplied to the Warsaw Pact nations, Egypt and Syria. FROG-7s were supplied to the Pact nations, Cuba, Egypt, Iraq, Kuwait, Libya, North Korea, South Yemen and Syria.

Scud-Bs were supplied to the Warsaw Pact, Egypt, Iran, Iraq, Libya, North Korea, South Yemen and Syria.

Scaleboards have been delivered to Iraq (15), Syria and, probably, Libya and Iran. SS-21s have been delivered to Syria (6 launchers, 18 missiles), East Germany, Czechoslovakia and an unknown customer (India or Iraq).

Biological weapons

The Soviet Union is a party to international agreements prohibiting the use of toxic chemicals and biological agents and requiring the destruction of stocks of biological (not chemical) weapons. However, the Soviets have renounced only the first use of chemical weapons. Open sources all show adherence to the Biological Warfare Convention of 1972, and the unpredictability of this form of warfare, combined with the effectiveness of their nuclear and chemical capabilities, makes the Soviets less likely to use biological weapons than any other types of weapons of mass destruction. The Soviets consider the definition of prohibited biological agents to be limited to bacteriological agents, thus excluding toxins.

Despite this, Soviet biological and bacteriological warfare research has apparently been continuing at a rapid pace, and they have reportedly developed a new range of diseases as well as countermeasures to any bacteriological or biological weapons they believe may be used against them. The Soviets have reportedly developed agents that would produce plague, cholera, anthrax, tularemia, lassa fever, ebola fever and marburg fever. There are 40 chemical and biological weapons storage depots in Eastern Europe and the European USSR.

Soviet biological warfare efforts were illuminated by an accident at Sverdlovsk in 1979, when what appeared to be an airborne strain of Anthrax-N was inadvertently released, causing casualties. This retention of an older (1940s-technology) but still effective agent in stockpiles (or, alternatively, for research and development) parallels Soviet chemical warfare practice; it does not mean that Anthrax-N is regarded as a currently operational agent. There have been repeated unconfirmed reports of Soviet work on new, more effective agents which could be introduced covertly before hostilities began.

Offensive use of chemical weapons

The Soviet Army is undoubtedly the world's foremost expert in chemical warfare. Chemical offensive capability is present at all levels, and it has reportedly been tested by the Egyptians in the Yemen in 1967, by the Vietnamese in Laos in 1979 and by the Soviets themselves in Afghanistan starting in 1980, as well as in many manoeuvres and exercises in the Soviet Union which are so realistic that they kill a number of soldiers every year.

A possible dramatic change in Soviet chemical warfare policy came in June 1987, when First Secretary Gorbachev announced the suspension of production of offensive chemical weapons and plans to destroy existing stockpiles. If this actually comes to pass, it will mean the reversal of a policy dating back to 1918.

In Afghanistan the Soviets have made limited but often effective use of a broad range of chemical weapons. This includes tricothecene toxin, nerve agents, phosgene, modern high-technology incapacitants, chloropicrin (an incapacitant), and CS and CN gases. Phosgene has been used as recently as 1984; casualties were treated by a US surgeon. Since late 1982 the use of lethal chemicals has been limited to older agents such as phosgene, and possibly some nerve agents. The US Department of State estimates that over 3,000 Afghan civilians were killed in chemical attacks in 1979–82.

While chemical weapons remain part of the Soviet NBC trinity of "weapons of mass destruction," their link with the other two elements has been weakened by technological advance and changes in practice. The Soviets have been willing to export large stocks of chemical weapons in peacetime. Recipients include Egypt (which used them in Yemen in the 1960s), Iraq (against Iran, starting in 1982), Afghanistan (using DRA-marked aircraft in 1979, before the Soviet invasion), Vietnam (repeated reports of lethal agents in use since 1976, with use of non-lethal gas dating from the 1960s) and, possibly, Ethiopia. Syria has a small chemical stockpile and uses Soviet-supplied systems for offensive and defensive CW training.

The danger of retaliation in kind is much less acute with chemical weapons, since NATO lacks an effective offensive chemical capability. If the Soviets initiate the use of chemicals, NATO's only recourse will be the limited US and French stockpiles or, failing that, nuclear weapons.

A number of reports – backed up by news from Afghanistan – suggest that the Soviets have succeeded in developing and using a new capability in the form of a non-toxic incapacitating agent. This would allow them to achieve all the benefits of chemical weapons use – forcing the enemy into protective suits, confusion, disruption – while not breaking the no-first-use provisions of the 1925 Geneva agreement (which does not deal with non-lethal agents) or exposing themselves to similar retaliation (NATO has only limited ageing stockpiles of CS and CN "teargas").

The decision to use chemical weapons will apparently be taken at the highest levels of the Soviet national command authority, although in the 1950s and early 1960s the Soviets had reportedly already made the decision to use chemical weapons in any future war. Today it is possible that the requirement for pre-release authority may also include non-lethal chemicals. The Soviets are more likely to use chemical weapons against an enemy who lacks the ability to retaliate with them or defend against them, a category into which the US Army fell until the late 1970s at least. Chemical weapons will normally be used in conjunction with nuclear or conventional munitions.

Soviet chemical weapons delivery systems include tactical aircraft (either aerosol spray or bombs), FROG and Scud missiles, multiple rocket launchers of all sizes and all 122mm and 152mm tube artillery. The missiles and the multiple rocket launchers have the biggest chemical warfare role. There may well be as many chemical warheads for missiles as there are nuclear ones. Multiple rocket ammunition stockpiles also contain considerable amounts of chemical weapons, in excess of the 5% proportion across all types of artillery ammunition.

In Afghanistan chemicals have been delivered mainly by means of bombs dropped from helicopters or fixed-wing aircraft, the method also used by Egypt in 1967 and Iraq in 1982–84. In one well documented incident in Afghanistan, chemical agent was pumped from a truck into a tunnel; this technique has also been taught to the Cuban Army. The artillery of the 103rd Guards Airborne Division in Afghanistan is known to be trained in CW delivery. Spray tanks can be very effective against targets with little air defence. Even crop-dusting aircraft – with their structure protected against corrosive substances and their crews trained to handle hazardous substances – can be used to deliver chemical agents. As new SSMs enter service, older types may be retained for CW delivery, in which precision is less important. A CW-armed Scud airburst will produce a lethal footprint measuring up to 4,000m long by 600m wide downwind.

Artist's impression of a Soviet chemical warfare bulk storage depot. A substantial proportion of the Soviet chemical stockpile is already loaded into the warheads of shells, rockets and missiles, and so would be in underground ammunition bunkers rather than depots like this. *(US Department of Defence)*

The Soviets have made the development and deployment of new chemical weapons a priority. The West, by contrast, has decided against fielding new-technology chemicals, instead concentrating its chemical warfare efforts on defensive techniques and equipment and on more effective ways of delivering current agents such as the US binary weapons.

Since the USA ceased production of chemical weapons in 1969, the Soviets have carried out an intensive build-up, with research and development to match. As a result, the Soviets' offensive chemical warfare capability is likely to be superior, and their agents much more sophisticated than the 1960s-technology nerve agents on which the West relies. The present situation is analogous to that which followed the German introduction of nerve agents during the Second World War: the Allies were unaware of the existence of such weapons and had therefore developed no defensive equipment and tactics.

Evidence from Afghanistan suggests that the new-technology chemical weapons in the Soviet inventory

could include tricothecene toxins, "The Flash" (an extremely lethal nerve agent) and Blue-X (an effective incapacitant that produces unconsciousness for one hour or longer). In the future the Soviets may deploy even more advanced chemical weapons, acquiring the capacity to synthesise organic toxins and produce gene agents capable of attacking elements of the target's genetic make-up.

In 1987 the Soviet Government denied that it had any stockpiles of high-technology chemical weapons, phosgene or blood agents such as hydrogen cyanide (AC). Total Soviet CW stockpile is estimated at 300,000 tons.

The extensive Soviet chemical warfare capability allows them to manufacture large quantities of almost any type of gas. It is confirmed that the Soviets use sarin (GB) semi-persistent nerve gas, soman (GD) semi-persistent nerve gas, mustard (H) blistering gas, TVX, VR-55 thickened nerve gas, VX (a V-agent), CS, lewisite, adamsite, chloropicrin and other gases not in NATO's small arsenal. The blood agents require a high concentration to work and therefore are likely to be used with missiles and MRLs, which can achieve the required concentrations. Iraq is reported to have used Soviet-supplied mustard gas against Iran, to substantial effect. Analysis of the agent showed it to be stable and effective.

High-technology Soviet agents could include:

Tricothecene toxin "Yellow Rain" is a highly lethal agent. A growth known as a mycotoxin, it may also be regarded as a biological weapon. It was used in action in Afghanistan in 1980–82. It has possibly also been used in Kampuchea, although this remains unconfirmed, and Iraq. In 1981 US protective equipment was thought to be effective against mycotoxins, although detection and antidote capability were lacking.

Blue-X Possibly a glycolate, an effective, non-lethal incapacitant. Used in action in Afghanistan. Blue-X is also known as a K (incapacitant) agent, although it can be lethal in large doses.

"The Flash" Journalistic name for a possible extremely fast-acting, highly lethal compound; possibly an improved nerve agent. Used in action on at least one instance in Afghanistan.

Genetic attack agents The Soviets are reported to have used recombinant DNA techniques in offensive weapons research. According to the US Department of Defence, Soviet genetic engineering research is being used to support the development of offensive chemical or biological agents. Professor Yuri A. Ovchinnikov, vice-president of the Soviet Academy of Sciences, has been associated with these efforts. It is not known whether this has led to deployable weapon systems.

The Soviets will attempt to use chemical weapons in such a way as to maximise the surprise effect, and introduction in a massive strike is more likely than gradual implementation. They will carefully judge which target requires chemical treatment and which chemicals will be used. Non-persistent agents are seen as excellent weapons of suppression, reducing the defenders' effectiveness without preventing advancing Soviet units, with their excellent NBC defensive equipment and training, from closing with the position. They can also be used where damage to terrain would slow the Soviet advance.

Non-persistent agents are likely to be used against defiles, river crossings and other points on the main axes of attack, to suppress resistance around drop zones or landing zones prior to airborne attacks, or against troops in contact. They will be used to secure the flanks of Soviet penetrations (an important consideration for deep thrusts) and block the movement of enemy reserves. Persistent gases will be used to interdict supply and movement routes. Key airfields will almost certainly be targets for missile-delivered persistent gas, restricting operations without preventing subsequent Soviet use. This has led to the widespread construction of defensive NBC systems and structures in NATO forward-area airfields. Other rear area facilities, ports and headquarters are also potential targets. Well dug-in positions, assembly areas and reserve units may also be hit. Afghanistan suggests that the Soviets will also use chemical weapons against civilian targets.

Smoke-generating capability is normally left to the artillery and individual vehicle generators. These may be supplemented by BDSh-5 smokepots. At a wind speed of five metres per second, a pot will generate a screen 500m long and 100m wide for about ten minutes. The TMS-65 can also be used as a smoke generator. Another smoke-generator vehicle, on a KrAZ-214 truck chassis, is believed to use an aircraft turbojet.

The Soviet concepts of "deep battle" and "operations in depth" require the simultaneous suppression of weapons and positions throughout the depths of the defence. As in the 1920s and 1930s, when these concepts originally emerged, the use of chemical weapons is seen as one of the most important means of suppression. The type of offensive tactics seen in Exercise Zapad-81 and, said to be on a larger scale, in Kavkaz-85 – rapidly moving combined-armed mechanised forces penetrating enemy positions in co-ordination with intense fire strikes – would be more effective if applied in concert with large-scale chemical weapons use.

The desire for the ability to win a war in Europe without using nuclear weapons makes chemical weapons more significant. If arms-control agreements reduce the number of nuclear delivery sytems, chemical weapons will grow further in importance. This is borne out by the continuing expansion of Soviet chemical warfare storage capacity: a 17.3% increase in 1970–75, followed by 9.9% in 1975–80 and 16.2% in 1980–85. Chemical weapons are stored in the Soviet Union, possibly Afghanistan and throughout Eastern Europe (the Soviets deny the last).

Unit organisation

Regimental NBC defence company (tank and motorised rifle regiments)
Total strength: one officer, 34 enlisted men, four BRDM-2RKh, two DKV, two ARS-12/14RK and one DDA-53/66 decontamination systems, one jeep or BRDM-2, one GAZ-66.

Divisional NBC defence battalion (tank and motorised rifle divisions)
Total strength: 225–260 officers and men.
- One battalion HQ (10 personnel, one jeep, two vans)
- One heavy decontamination company (55 personnel, 10 ARS-12/14, two DDA-53/66, two TMS-65, eight trucks)
- One light decontamination company (55 personnel, six ARS-12U/14, two DDA-53/66, two DKV, eight trucks)
- One chemical reconnaissance platoon (35 personnel, nine BRDM-2RKh, one jeep)
- One technical service and maintenance platoon (30 personnel, two ARS-12U/14, five maintenance vans, five trucks, four POL trucks)
- One service platoon (20 personnel, two ARS-12U/14, six trucks, one jeep, one ambulance)

NBC defence battalion (army)
Total strength: 44 officers, 474 enlisted men.
- Headquarters and services (three officers, 30 enlisted men, two BRDMs, seven trucks)
- Three chemical companies (each of 11 officers, 128 enlisted men, six ARS-14, two DDA-53, one TMS-65, 10 trucks)
- One chemical reconnaissance company (eight officers, 60 enlisted men, 15 BRDM-RKh, five trucks)

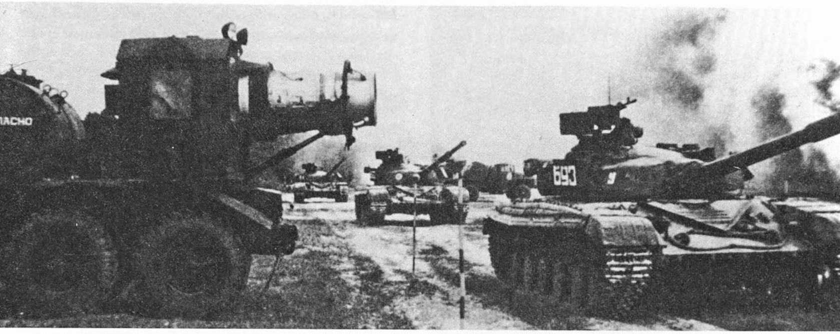
NBC defence brigade (front level)
Total strength: 71 officers, 668 enlisted men.
- Headquarters and services (11 officers, 73 enlisted men, two BRDMs, 12 trucks)
- Three chemical battalions (each of 12 officers, 138 enlisted men, 18 ARS-14, six DDA-53, three TMS-65, 20 trucks)
- One chemical reconnaissance battalion (24 officers, 181 enlisted men, 45 BRDM-RKh, 15 trucks)

NBC defence

The Soviets realise that for any force to survive in modern warfare it must take steps to defend itself against the NBC weapons that have the potential to dominate the battlefield. NBC defence is designed into all Soviet weapons and vehicles, incorporated into all Soviet strategy, operations and tactics. The technical aspects of NBC defence in the field fall to the Chemical Troops.

The Chemical Troops are a "special troops" branch,

BRDM-2RKh vehicles being decontaminated. Some of the soldiers are wearing the dark-coloured heavy protective suits used by decontamination units. These suits are very thick and bulky.



Two TMS-65s decontaminate a column of T-64 tanks. *(US Department of Defence)*

directly responsible to the Ministry of Defence. Its 80,000–100,000 men provide NBC defence and training to all the services of the armed forces. Not only is every soldier in the Soviet Army thoroughly trained in NBC defence and personally equipped to enable him to operate under NBC conditions, but Chemical Troops NBC defence units are available at all levels of command, from regiment up to front. NBC reconnaissance vehicles are found throughout the Army, their role being to find contaminated areas and warn of attacks, aided by radio broadcasts over a special NBC network. Aided by engineers, NBC defence units will train troops in NBC defence, decontaminate areas, personnel and equipment, and detect enemy NBC activity. This is done by NBC reconnaissance vehicles, NBC patrols and individual specialists with measuring equipment.

The 1986 Chernobyl reactor accident resulted in a demonstration of Soviet field decontamination procedures. Mi-26 Halo helicopters sprayed decontamination fluid, and ground NBC units were also used. One of the latter – containing a number of reservists, predominantly Estonians – is reported to have refused duty.

The widespread issue of Soviet NBC defensive equipment is intended to counteract its design limitations. The heaviness and outmoded nature of this kit is well known. The decontamination equipment – with the exception of the TMS-65 and, possibly, other items not yet revealed publicly – is also unsophisticated in design. These systems are effective, however, but only because they are so plentiful. Field expedients and captured equipment would be used whenever possible: captured Western-style car washes, for example, would be repaired and brought back into service as decontamination facilities.

Because NATO lacks a comparable offensive chemical capability, the Chemical Troops train principally for nuclear conditions and in the techniques needed to permit Soviet forces to operate in areas contaminated by their own chemical strikes. The scenario that dominates NATO defensive NBC thinking – surprise chemical strikes – is much less important to the Soviets.

Responsibility for NBC defence is by no means limited to the Chemical Troops but runs throughout the Soviet military, including the civil defence forces. It consequently forms a significant part of civilian (including pre-conscription) military training, and of tactical training for units of all branches. The Soviet Army has over 1,000 CW training ranges, including 40–50 in Eastern Europe and 3–5 in Afghanistan. Less than 10% are for the use of the Chemical Troops, the remainder being for the training of tactical units and sub-units in defensive operations.

However, the main defence against NBC is seen to lie not in these measures but in denying the enemy the opportunity to use such weapons. Thus operations and tactics are regarded as complementary to equipment in the provision of NBC defence for the Soviet Army.

NBC defence equipment

ShM protective mask The standard Soviet mask, this consists of facepiece (without voice transmitter), hose and canister, which can be changed without taking off the mask. Like all gas masks, it is fatiguing to wear. Valves tend to freeze and hoses crack in cold weather. The ShMK has a voice emitter, as does the ShMS, used with optical devices. An improved filter has been fitted for use in conjunction with tricothecene toxin and other high-technology chemical agents. Examples of such improved masks have been captured in Afghanistan, two of them with traces of these agents still in the filters.

Standard ShM "Shlem" protective mask. Early models lack the outlet valve mounted on the facepiece. New versions have no hose and a smaller conical canister. *(US Army)*

Protective overalls The Soviets have several NBC suits, most of rubberised fabric with gloves, hood and rubber boots. ZFK-58 heavy suits of cloth-lined rubber are used by Chemical Troops or others who are liable to work in contaminated areas. Reconnaissance troops use the L-1 butyl rubberised fabric suit. Much heavier and less comfortable than Western suits, Soviet NBC protective suits can be worn for three or more hours only when the temperature is below 15°C; this period decreases to 15–20min if the temperature is 30° or more. Suits are not intended to be worn constantly in readiness for surprise chemical use. Troops normally use gas masks only when mounted in tanks or armoured vehicles equipped with NBC overpressure or filtration systems; truck-mounted troops wear the NBC suit as a coat rather than as overalls. Soviet troops have been seen in action in NBC suits in Afghanistan.

Individual kits Each soldier has an MSP-18 treatment kit with antidotes to a variety of chemical weapons, an IDP decontamination kit for weapons, and an IPP individual decontamination kit.

IPDS-69 Squad-level decontamination and degassing kit, normally vehicle-mounted.

Weapons decontamination kits The PM-DK is used on machine guns and mortars; the ADK is used on artillery. Both travel with the weapon and the kits are manually applied by the crew.

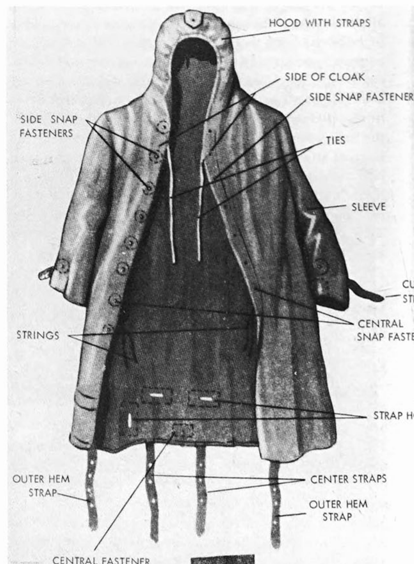
DK-4 Decontaminant equipment for trucks; uses exhaust gases to create an aerosol spray. Similar systems comprise the DKV for tanks (one 30lit spray canister needed for chemical decontamination, three for NBC), DK-4B for APCs, DK-4K for ZIL/GAZ trucks and DK-5 for airborne forces. Each NBC company holds 43 or 76 canisters.

RDP-4W Portable decontamination device; large tank with sprayer.

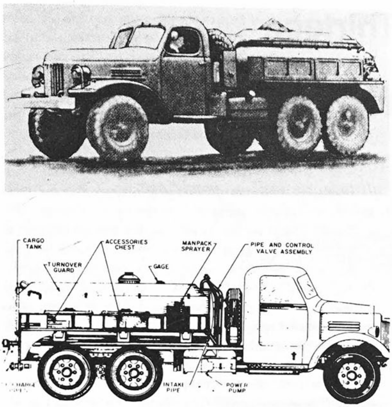
ARS-12U/-14 These two vehicles, using ZIL-131/157 truck chassis, are standard decontamination systems. The ARS-12U's 2,500lit tank has enough decontaminant for 25 tanks. The ARS-14 has a larger tank. Both have hoses, brushes and special-purpose nozzles. Steam decontamination and a shower apparatus are also available.

TMS-65 One of the more spectacular NBC defence weapons, the TMS-65 is a modified aircraft turbojet mounted on a Ural-375, using heat and water or decontamination fluid to decontaminate a tank in one to three minutes. It can also be used as a smoke generator.

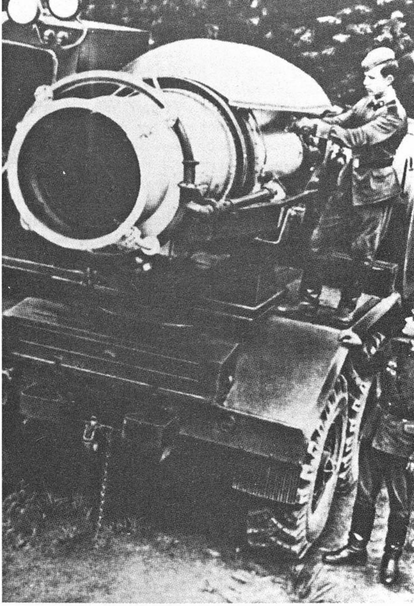
DDA-53 Two steam chambers and a boiler for clothing and equipment decontamination, mounted on a GAZ-63 chassis.



OP-1 standard NBC protective suit. *(US Army)*



ARS-12U decontamination vehicle. *(US Army)*



TMS-65 decontamination vehicle, showing the jet decontamination sprayer and fluid storage tank. *(US Army)*

ADM-48 Mounted in the back of a standard truck, this apparatus has two decontaminant tanks with hoses with brush heads, used to wash equipment manually.

GSP-1 and GSP-1M Vehicle-mounted radiation and nerve gas detectors, with visual and audible alarms. Used on NBC reconnaissance versions of the BTR-40, BRDM-1, BRDM-2 and UAZ-469.

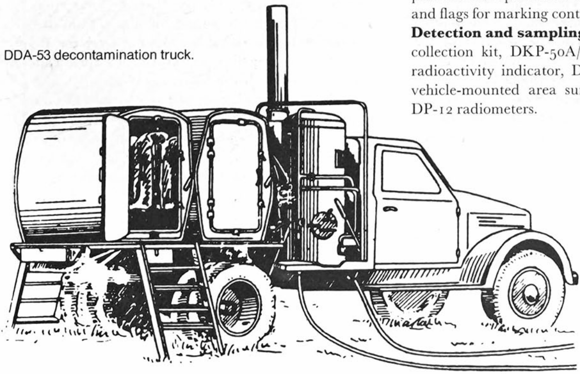
VPKhR Standard man-carried chemical detector, used to identify precise agents used.

GSP-11 Automatic version of the VPKhR.

NBC reconnaissance vehicles "RKh" versions of the GAZ/UAZ-69/469 jeep, BTR-40, BRDM-1 and BRDM-2, plus RKhM specialised vehicles, all with sensor devices and flags for marking contaminated areas and safe lanes.

Detection and sampling Equipment includes KPO-1 collection kit, DKP-50A/DS-50 dosimeters, DP-63A/64 radioactivity indicator, DP-2 man-portable and DP-3B vehicle-mounted area survey meters, and DP-SA and DP-12 radiometers.

DDA-53 decontamination truck.



Chapter Thirteen

Air defence

"The Air Defence troops of the Army are capable of combating threats at low, medium and high altitude, as well as providing continuous cover for Army units and rear-area facilities."

MARSHAL A.A. GRECHKO
(FORMER MINISTER OF DEFENCE)

The side that controls the air will often control the battlefield beneath it as well. The Soviet Army is determined that in future opponents shall not enjoy this control.

The Soviets recognise that air defence is an essential component of the modern combined-arms force, and have made the Air Defence of the Army a separate branch, on a level with the Tank, Motorised Rifle and Artillery branches. But Air Defence is more than just another branch of service. Since 1981 it has been an integral part of the *Voiska* PVO (Air Defence Force), which is a separate service. Thus the soldiers who man the self-propelled anti-aircraft guns and SAM launchers in regiments and divisions are not administratively part of the Army, even though they are for tactical and organisational purposes.

Unlike the defensive belts in Egypt, North Vietnam or even the Soviet homeland, Soviet Army air-defence operations are basically offensive. The mobility, tactical flexibility and combat power of the latest Soviet air-defence weaponry allows the Army's air-defence forces to provide the protection from enemy air strikes that a modern army needs not only to win but to survive. The Soviets know that NATO tactical air power is very effective and more flexible than their own. Columns of Soviet troops are excellent targets, and the terrain of West Germany abounds in choke points and defiles where air strikes could inflict devastating losses and delay the Soviet advance, an advance that must be relentless to be victorious.

There are four principles to Soviet Army air defence: mass, mix, mobility and integration. Mass has never been a Soviet weakness. Anti-aircraft artillery (AAA) and surface-to-air missiles (SAMs) are provided at all levels of command on a scale greater than in any other army. Mix is created by the complementary nature of the weapons, the differing types that will still provide air cover should countermeasures reduce the effectiveness of any one system. As the air battle in any future war will be largely electronic, this is especially important. Mobility is emphasised in the design of the weapons themselves. Even relatively static systems such as the SA-2 and SA-3 and their radar sites can be packed up and made ready to move to an alternative position in three to four hours. In June 1970 a belt of these SAMs moved forward literally overnight from positions deep in Egypt to the Suez Canal. Finally, air-defence assets are completely integrated throughout the Soviet Army. Every commander can deploy air-defence weapons, from front-level SAM brigades to each platoon's SA-7 launcher.

If the Soviet Army is to carry out its wartime role as the arm of decision, air defence must keep enemy air power from interfering. The Second World War taught the Soviets the devastating potential of tactical air power, both in striking combat troops and attacking their supply lines. The aircraft still has the advantage over any enemy on the ground. For all its importance, air defence alone is not, and has never been, a decisive arm. In 1972 Hanoi was defended by 6,000 anti-aircraft guns (three times the number that ringed Berlin), half of them radar-controlled, supplemented by 156 SA-2 launchers with stockpiles big enough to permit the firing of up to 100 missiles simultaneously. However, five days of intensive US air strikes defeated even these powerful forces, and US aircraft roamed the skies of North Vietnam at will.

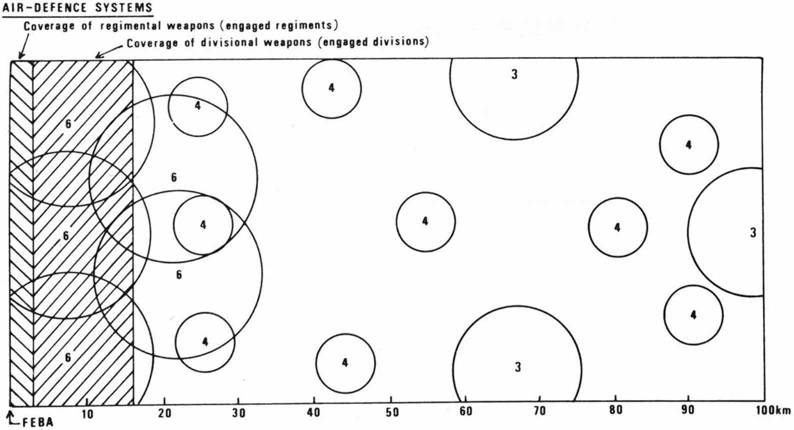
The Egyptian air-defence belt along the Suez Canal in 1973 was as dense as that around Moscow itself, the SAM sites and their attendant radars being fortified by reinforced concrete and ringed by light AAA. The combined expertise of Soviet technicians and Egyptian combat veterans left nothing to chance. In the first three days of the war the Egyptians and Syrians fired off more SAMs than NATO currently possesses, but while the Israelis suffered heavily, the defences destroyed almost as many Arab aircraft as Israeli. Even the modern SA-6 hit a target only about once in every fifty launches, and this was against an air force that was surprised, suffering from overconfidence, and lacking adequate ECM and effective tactics in the first crucial days of the war.

In what must have been the best possible case for the air

defences, Suez in 1973 demonstrated that no ground air defences – even those of Soviet quality – can ever totally defeat aircraft, although some point targets, especially bridges, can be successfully defended by static air defences. The American defence of the Remagen bridge in 1945, and the effective Egyptian defence of the Suez Canal bridges on October 6–8, 1973, prove this. However, the increasing employment of contemporary precision-guided munitions and stand-off weapons has greatly increased the power of strike aircraft, especially against targets such as bridges.

In modern warfare, if attacking aircraft have the determination to press on, take their losses and attack their targets, all air-defence can do is to make it more costly, more difficult and more time-consuming for them to accomplish their mission. This is all that the Soviet Army's air defences have to do to succeed. They need not destroy NATO aircraft (that can be left to the Air Force); all they need do is reduce the effectiveness of enemy air attacks in the first, crucial days of the war. Their success will be measured not in aircraft destroyed, but rather in the number of bombs or missiles that miss their targets because a pilot has to evade SAMs or AAA, or in the number of air attacks that must be diverted from striking Soviet tanks to suppressing the air-defence forces. Even though the air-defence systems of both North Vietnam in 1972 and the Arab nations in 1973 were defeated, they did accomplish this mission. Over North Vietnam 25–50% of the US sorties on any given day were committed to air-defence suppression, sorties that could otherwise have supported the main bombing effort. US defence analysts termed this "virtual attrition", which, like the "actual attrition" of shooting down aeroplanes, reduced America's ability to defeat North Vietnam. The Israeli air attacks on Arab SAM sites in 1973 also absorbed a large percentage of their total strike capability, especially at such crucial periods as "the Battle of the Syrian SAMs" on the afternoon of October 7, and during the breaching of the Egyptian SAM belt between October 9 and 14. Every strike at a SAM site was a strike diverted from Arab combat units. The very existence of the Arab air defences prevented the Israeli aircraft from using the long, low, slow passes that allowed them to plant their bombs with such accuracy in 1967. Operations research data from the Second World War show that any anti-aircraft fire, no matter how inaccurate, is sufficient to reduce the bombing accuracy of attacking aircraft by at least 50%. The threat of air-defence fire can be as effective as the fire itself.

The spectacular defeats of Syrian air and air-defence



This diagram shows the air-defence cover of a typical Soviet Army sector extending 100km behind the forward edge of the battle area (FEBA) and along 45km of frontage. In addition to the missile and AAA defences shown (each type of SAM is represented by the appropriate numeral), the Soviets position point-defence systems not only on the front lines but throughout the sector. Second-echelon regiments and divisions will be behind the FEBA, and their weapons will fill in any gaps under the area-defence missile systems. The radii shown are the US Air Force's "avoidance radii", which they will not penetrate unless required. If maximum range were used, the whole sector would be covered. If SA-11 were used instead of SA-6, radii would increase by about 150%. If SA-12 replaced SA-4, radii would increase 300%.

forces by the Israeli Air Force in 1982 raised concern throughout the Soviet military, but particularly among those responsible for ground-based air defence. Subsequent articles in the military press suggest that the air defences came under intense scrutiny, just as the armoured forces had done following the massacres of Syrian armour in 1973. It was feared that NATO could repeat on the Central Front against Soviet air defences the Israeli success against the same weapons in Syrian hands.

Analysis revealed that there were key differences between the Syrian situation and that of the Soviets: the Israelis had had time for extensive reconnaissance; the advance of Israeli tank forces had forced many SAM batteries to displace, thus greatly increasing their vulnerability; and the Syrian Air Force had proved incapable of helping the SAM defences. Nonetheless, the Soviets appear to have been prompted to fundamentally alter their air defence system and, possibly, to improve certain weapon systems.

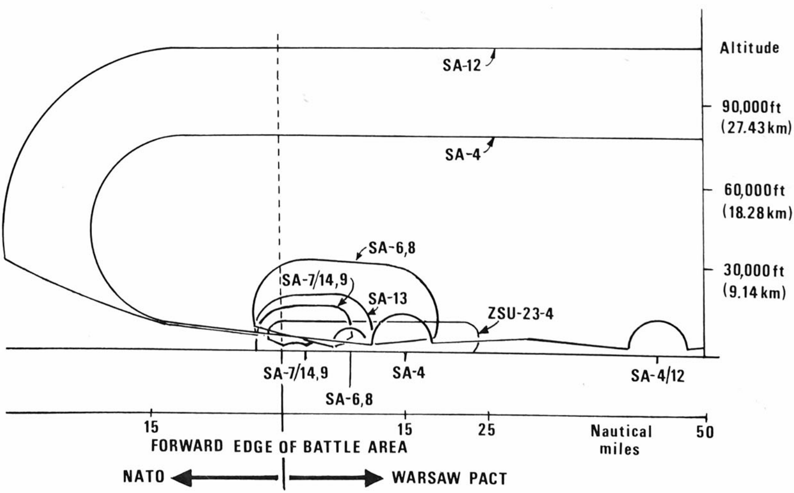
In the long run, modern aircraft with effective ECM and tactics could probably defeat a typical Soviet air-defence system. The Soviet concept of the short, victorious war is intended to deprive their enemies of that long run.

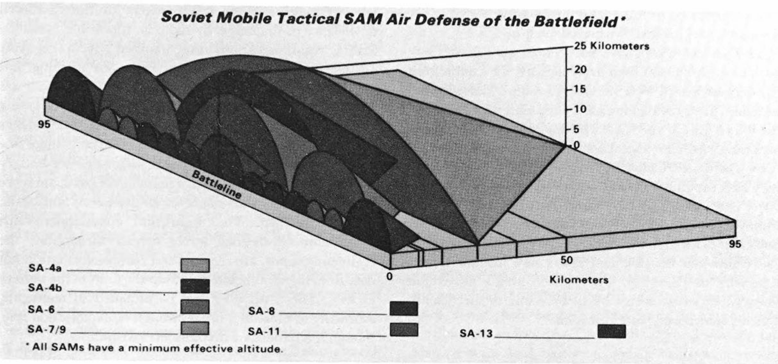
Weapons and employment

The air-defence weapons of the Soviet Army include both area-defence and point-defence weapons. The big SAMs – the older SA-2, SA-3 and SA-4 or the newer SA-10 and SA-12 – provide area cover when employed by front and army-level SAM brigades, co-ordinated with massed "Fire Storm" defensive operations by fighter aircraft of the supporting tactical air army. However, the fighters fly under 4,000m (13,000ft) altitude only at their peril, because the Army is primarily responsible for engaging targets below that ceiling. Even without supporting fighters, the SAM units can provide air defence cover throughout the front or army area of operations. Point-defence weapons must be positioned near the targets they defend. The bulk of the Soviet air-defence weapons are intended for point defence. The SA-6/11 and SA-8/15 bridge the gap between the point and area-defence weapons. All Soviet air-defence weapons are tied into a comprehensive and efficient early-warning and target-acquisition radar network.

The organisation of Soviet Army air defences allows all levels of command to push their assets forward. A

SOVIET ARMY MOBILE SAM/AAA COVERAGE





The overlapping effective areas of Soviet tactical SAMs have increased with the introduction of new systems. *(US Department of Defence)*

regiment's ZSUs can be 500m behind the forward tanks, for instance, while a division's SAM regiment, equipped with SA-6, SA-8 or SA-11, can have its subordinate batteries up to 20km from the regimental CP. The batteries themselves can be as close as 2–5km from the FLOT, with each launch vehicle 100–700m from the battery CP. This puts a strain on logistics, and one of the lessons the Soviets drew from the 1982 Lebanon War was the importance of missile resupply. They appear to have increased the number of missile transport vehicles held at regimental level since the 1970s; have provided batteries with specialised transloader vehicles designed for rapid reloading; and have created a special logistic system, managed by the Air Defence Troops, which is capable of skip-echelon resupply of forward-deployed assets.

The Soviet Army is only able to have mix, mobility and integration in its air-defence forces because of the individual quality and complementary capabilities of its SAMs, AAA, radars and supporting fighters. The Soviets deploy their air-defence weapons throughout an army sector so that the effective envelopes of each weapon overlap, forming a complete air-defence umbrella. The positioning and coverage of the air-defence assets of a typical Soviet army allow the integration of both area and point-defence weapons into an effective, complementary network. In 1973 Israeli aircraft that dived under SA-6s ran into the fire of ZSU-23-4s. Those aircraft attempting to fly above the SA-6's envelope would be driven back into it by having to outmanoeuvre high-altitude SAMs. If a Fan Song radar loses a target in ground clutter (surface reflection of the radar's pulses), a Low Blow, optimised for low-altitude work, will pick it up.

Weapons integration is carried down to regimental air-defence batteries with their mixture of SA-9/13s and ZSU-23-4s. Any pilot will try to adjust his tactics to minimise vulnerability to these weapons and will watch for them on the ground, but in doing so he leaves himself open to enemy fighters. Many US aircraft were lost to MiGs over North Vietnam while their crews were trying to avoid SAMs and AAA. The multiplicity and mass of systems means that even if a particular site is destroyed or an individual type of radar is jammed, the system itself will continue to function, at least until the enemy puts his air effort into a direct and costly assault on the air defences.

Soviet AA and SAM technology has been comparable with that of Western nations since the Second World War, from guns to the current SA-8, which is similar to the Rapier or Crotale SAM systems adopted by NATO. Other, more modern, Soviet SAMs have capabilities that NATO has not yet achieved; these include the anti-tactical ballistic missile capability of the SA-12. It has been widely reported that the Soviets use vacuum tubes in their electronics in place of the transistors used in Western equipment. This increases the fragility and bulk of some electronics, but miniaturisation has seldom been a concern of either the Soviet Army or Soviet society. While they are far behind the West in transistor and microcomputer technology, their increased emphasis on vacuum tubes has put them 10–15 years ahead in that area. However, they still suffer many of the disadvantages inherent in the use of vacuum tubes. Those of some of the early-warning radars deployed in Egypt developed difficult cooling problems, emitting vast clouds of steam. The temperatures inside the radar vans would reach 70°C, often forcing the crew to

evacuate. The latest SAMs and radars are reported to use transistors and printed, integrated circuits.

The Soviets' use of Western technology has nowhere been more significant than in air defence. This dates from the Second World War: lend-lease radars and weapons supplied then provided the basis of systems that are still in use today. Just as the Russians were able to close gaps in areas such as heavy bombers (by producing B-29s) and turbojets (by producing Rolls-Royce Nenes) in the 1940s, they have sought to repeat this process in electronics in the 1970s and 1980s. This has been reflected in the turn away from vacuum-tube to solid-state technology seen in many Soviet air defence systems since the 1970s. Combined with the protracted development times now commonplace, especially in the USA, the Soviets' ability to exploit Western expertise seems likely to result in air defence systems of increasing sophistication.

Command and control

The Soviets aim for close co-ordination of air defence with manoeuvre units from battalion upwards, while retaining flexibility of operation and centralisation of control of all air-defence assets under the air defence commanders at all levels of command, from regiment (where regimental air defence battery commander performs this role) through to division, army, front and TVD. It is at the last level of command that operational air defences, including the assets of all Army formations and the Air Force's fighters and interceptors, are brought together, under the TVD's deputy commander for air defence.

Air Defence branch officers are attached at all headquarters down to regimental level. They retain centralised control of air-defence assets and deploy them as the situation demands. At TVD, front and army level there is a separate Air Defence commander and staff, usually co-located with general headquarters. While the Air Defence commander is subordinate to the unit commander, he is responsible for the co-ordination of air-defence efforts with the manoeuvre units, which, at army and front level, include area-defence SAM brigades and fighter support. The long range and high speed of these weapons necessitate centralised high-level control. The divisional Air Defence commander will be in full charge of the division's air-defence efforts. This will include deploying its AAA, SAMs and radars, setting up co-ordination procedures with the manoeuvre units, and establishing the priority of the points to be defended.

The Soviets normally assign highest priority to protecting their nuclear-capable weapons, followed by headquarters, assembly area, river crossing sites, defiles and other key targets. Tank and motorised rifle regiments are covered by their own anti-aircraft battery.

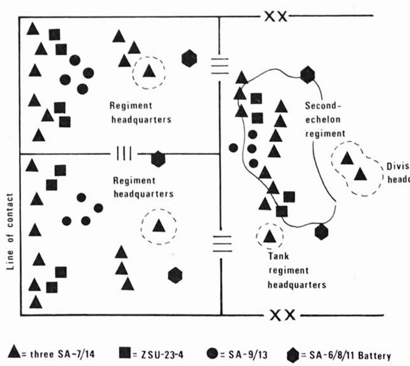
Early-warning information is passed from front or army-level air-defence headquarters to the divisional air-defence commanders by radio or, if possible, landline. Radio communications are handled by a separate air-defence network which is reserved for warning and target designation. Regimental anti-aircraft batteries are also "netted in," which provides the necessary targeting information for low levels of organisation. The Soviets maintain air-defence command and control at these low levels by having the commander of an air-defence battery or platoon that is attached to a manoeuvre battalion serve as that battalion's staff officer for air defence as long as the unit is attached. The regimental commander must co-ordinate air-defence forces spread throughout the regiment's sector. He receives and relays information not only from higher echelons but from the units of the battery as well. The SA-8 may also be attached to regiments, especially to those in a breakthrough or exploitation role, though it is basically a division-level weapon.

Tactical framework

The primacy of the offensive dominates Soviet Army air defence as much as any other branch of the Army. Great emphasis is placed on providing protection for advancing units. All AAA and self-propelled SAMs are trained to fire on the move or from short halts on the line of march. If the intensity of the air threat requires it, the Soviets will deploy air-defence units along the axis of advance. Warning radars will move by bounds to provide continuous coverage, supplemented by visual observation from all vehicles.

The actual use of each air-defence weapon depends on its position in the system as a whole. SAMs must always be

MOTORISED RIFLE DIVISION AIR DEFENCE DEPLOYMENT



deployed to minimise the effect of their "dead zones," the spaces below their effective envelope where low-flying aircraft can avoid the SAM's radar, and the cone-shaped zone above the launcher. Because of the reaction time of the SAM launcher – estimated at 16sec with IFF (identification, friend or foe) radar transponder interrogation and eight seconds without it – effectiveness declines against manoeuvring or rapidly closing targets, especially when the flight time of the SAM itself is taken into account. The US Air Force believes that the effectiveness of SAMs will be greatly reduced if its aircraft maintain a certain distance from the launcher – the "avoidance radius". To increase detection range, the Soviets will try to position radars on high ground.

The Soviets place great emphasis on air-defence cover during river-crossing operations, when their manoeuvre units are particularly vulnerable. The basic "leapfrog" technique, whereby units alternate between moving and firing, is retained. One section of a regimental anti-aircraft battery will be deployed on the near bank to cover the attack, and the remainder will cross when enemy direct-fire weapons have been cleared from the crossing area, with radar and resupply vehicles following as closely as possible. The SA-8, with its boat-like hull and integral radar, appears to be designed with the problems of river crossing specifically in mind. If the operation encounters heavy air opposition the spearhead regiment will hold its air-defence assets back to cover the crossing, relying on the second-echelon regiments or the divisional anti-aircraft regiment to cover the troops on the far bank. In addition, SA-7/14 launchers may be detached from their units to help guard the crossing site. This is possible because the divisional air-defence commander can use the air-defence radio network to redistribute all the weapons as the situation requires.

"A battery seen is a battery lost" was Napoleon's axiom, and this also forms the basis for much of the Soviet Army's air-defence tactics. To avoid revealing the positions of an entire unit, individual targets will usually be engaged by one or two designated guns or SAM launchers. When concealment is less important or when multiple targets appear, the whole unit will fire, relocating if necessary to avoid being attacked. When possible, alternative positions will be set up, usually within 500m of the original. Failure to provide alternative positions greatly increased the vulnerability of the Egyptians' Soviet-made air-defence weapons in the 1967 War.

The need to change position constantly on the modern battlefield has led to the use of "roving" anti-aircraft units. Able to react in a fluid battlefield situation, these units actively seek to engage enemy aircraft, moving from sector to sector wherever they are needed. This would also serve to confuse enemy estimates of Soviet air-defence strength. The Soviets realise, however, that roving units are vulnerable to attack if caught on the move, especially in daylight. This is what happened to many of the Syrian SAM batteries destroyed in the 1982 War. It is also difficult to maintain a flow of information to and from the roving unit and work it into the defence system.

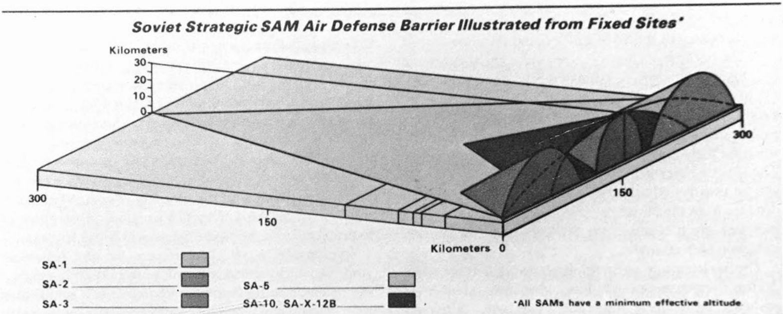
The anti-aircraft ambush relies on concealment for its effectiveness. A defensive tactic, it is used when available assets cannot provide complete cover. Ambushes can also be used to cover any gaps between air-defence systems. An anti-aircraft ambush is usually set up along likely approach routes for low-flying enemy aircraft, especially helicopters. This was the primary North Vietnamese method of using AAA in South Vietnam, and was also used to supplement the belt-type defences in North Vietnam.

The Soviets have great respect for the helicopter gunship, which, armed with anti-tank guided missiles, has the potential to decimate Soviet units. As a result, they have placed great emphasis on defeating the gunship with air-defence weaponry. They will often designate one platoon of an AAA battery to engage helicopters, relying on visual target acquisition rather than radar, which, though more accurate, takes longer to lock on. Guns firing on helicopters do not adjust their fire, as intensity is more important than accuracy. It is only necessary to disturb the ATGM gunner's aim. The Soviets have so inculcated their troops with the need to suppress helicopters that on manoeuvres every infantryman and SA-7/14 gunner who sees a helicopter will blaze away at it, regardless of whether it is in range, wasting much ammunition as a result. Forces operating behind enemy lines will usually hold their fire to avoid being located, however.

National air defence

In 1948 PVO *Strany* (National Air Defence Force) was formed as a separate service to meet the threat of Allied strategic bombing. By the 1960s it ranked third in the Soviet military hierarchy of services, behind the Strategic Rocket Forces and the Army itself. PVO *Strany* had its own forces of interceptor regiments, air defence radars, large-calibre AAA and SAMs, and its own command structure, with air defence districts covering the Soviet Union and reporting directly to PVO *Strany* headquarters in Moscow. Although the Army had given up its heavy AAA and radar in static defence positions in the Soviet Union to PVO *Strany*, it retained its own AAA and, later, SAMs as part of PVO-SV (Air Defence Troops of the Ground Forces). The latter's formations were subordinate to Army headquarters: military districts or Groups of Forces in peacetime, fronts or armies in wartime. Those in the Soviet Union were not an integral part of PVO *Strany*'s air defence network.

In 1981 PVO *Strany* was renamed and reorganised, while retaining its identity as a separate service. It acquired most if not all of PVO-SV, including its schools



The abolition of the former divisions between PVO-SV and PVO *Strany* means that the full range of Soviet SAMs are now deployed according to tactical need rather than ownership. *(US Department of Defence)*

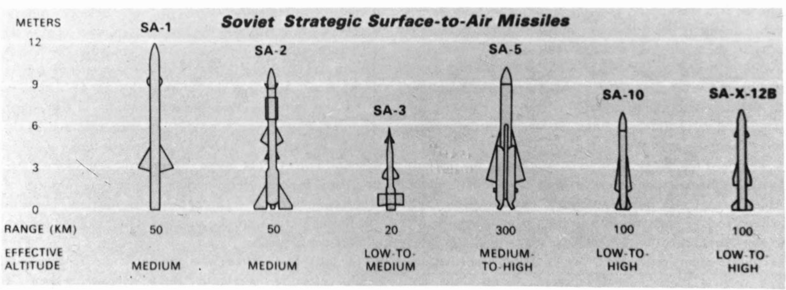
and academy. The new service, the *Voiska* PVO (Air Defence Force), was a follow-on to PVO *Strany* and retained the same commander-in-chief (until he was sacked in 1987 after a Cessna 172 landed in Red Square). The former PVO-SV was organised as a subservice, Troop Air Defence (*Voiskovaya* PVO), under the First Deputy Commander in Chief of *Voiska* PVO.

Voiskovaya PVO, basically PVO-SV renamed and resubordinated, retains the earlier force's mission of air defence of Army troops. While this means that on paper the Soviet Army no longer owns its air defence assets, the *Voiskovaya* PVO forces are actually the same as those of the PVO-SV of 1948–81. *Voiskovaya* PVO probably depends on *Voiska* PVO mainly for technical and administrative support rather than being subordinate to it in the full sense.

While *Voiska* PVO retains PVO *Strany*'s mission of defence of the Soviet Union, it has lost the earlier service's separate command hierarchy. The air defence district headquarters, with the exception of Moscow (the commander of which was also sacked in 1987 after the Cessna incident), are no longer independent operational HQs. The *Voiska* PVO's PRO (Anti-Ballistic Missile Troops) and PKO (Anti-Space Defence Troops) report directly, through Air Defence Force headquarters, to the General Staff. In 1981–84 the former PVO *Strany*'s interceptor force was reorganised as the A-PVO (*Aviatsia* PVO) and had 45% to 75% of its combat aircraft transferred to the Air Force, along with most of its training establishments.

The loss of most of the separate PVO *Strany* hierarchy means that the functions of the air defence districts have been taken over by TVD and military district headquarters, where the air defence operation will be controlled by the deputy commander for air defence. In wartime, front-level headquarters will probably also have a similar deputy commander.

In 1987, even before the Cessna 172 incident, there were



Soviet strategic SAMs, from the obsolescent SA-1 to the highly capable SA-X-12. *(US Department of Defence)*

indications that at least some air defence assets that had been under military district command since 1981 might be recentralised under *Voiska* PVO command. It is not known whether the air defence districts will re-emerge as separate commands, or how many forces have been resubordinated. There are reports of an alternative national air defence command centre being established near Kalinin.

Air defence in Afghanistan

Though the role of air defence in a war in which the opposition has no aircraft is of course limited, the Soviets have deployed and used air defence assets in Afghanistan. This is more reasonable than it seems: having committed their ground troops to Afghanistan, the Soviet commanders had no intention of leaving them without air cover.

The Soviets saw the main threat to the Communist government of the Democratic Republic of Afghanistan (DRA) at the time of their December 1979 invasion as coming not from Afghan guerrillas but from conventional forces. It may be that they actually believed that US, Chinese and Pakistani forces might become involved, as Soviet propaganda alleged. But it is more likely that it was *en masse* resistance by the DRA military, possibly including air attacks, that they feared most.

The presence of air defence weapons with the Soviet Army in Afghanistan is also a political statement, declaring to potentially hostile nations in the region that the Army can defend itself against air attack.

The following anti-aircraft systems have been deployed in Afghanistan:

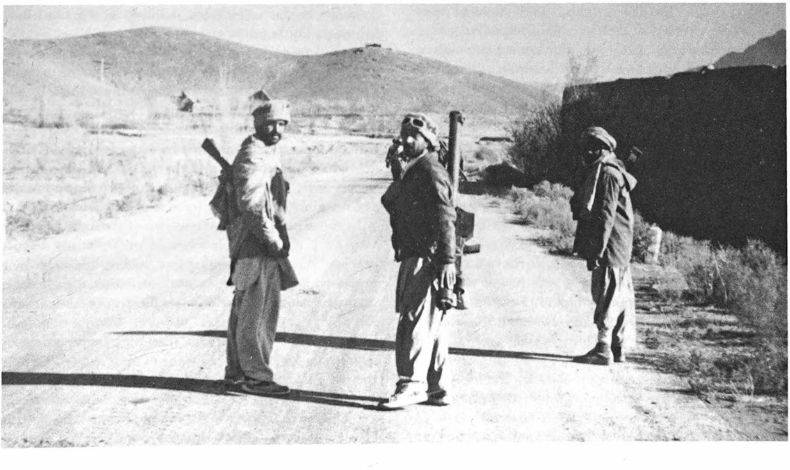
SA-2 Guideline This missile was in the inventory of the Afghan Air and Air Defence Force before the war. Launchers are deployed around Kabul and at military airfields such as Shindand and Bagram in standard hardened emplacements. The personnel of the two missile groups, the 880th and 990th, are also used as light infantry. The main SAM storage site in Afghanistan, at Qargha, was destroyed in a Resistance rocket attack in 1986.

SA-3 Goa The Air and Air Defence Force has received SA-3 Goa SAMs mounted on quadruple launchers. Probably deployed in the airfield defence role, they may be augmenting SA-2s.

SA-4 Ganef When the 40th Army crossed the border, it brought with it a brigade of SA-4 Ganef self-propelled SAMs. These launchers were seen around Kabul Airport in December 1979 but are reported to have been withdrawn in spring 1980.

SA-7 Grail Used by the Afghan guerrillas in limited numbers since the beginning of the war. More arrived in 1981, followed by an increased supply of SA-7Bs starting in 1984. Grail has also been deployed by the Communist forces. The DRA had SA-7s before the 1979 invasion, although these weapons are reported to have been taken

November 1, 1984: Afghan guerrillas armed with an SA-7b launcher on the main Kabul-Kandahar highway. They are on their way to an anti-aircraft ambush that was to yield a Hip shot down. *(Nabi Wardak)*



away by Soviet troops in 1980. Surprisingly, even though an air threat never materialised, and in view of the damage that captured SA-7s could inflict, Soviet units continued to carry this weapon in the field. In the Panjshir V offensive of spring 1982 the heliborne blocking forces inserted ahead of the combined-arms mechanised formations to block Afghan retreat routes were equipped with SA-7s. At least one of these groups suffered losses to the Afghans, who captured nine SA-7 rounds and a number of launchers. The missiles were then fired at Soviet targets, though no kills were achieved.

SA-8 Gecko At least three of the Soviet divisions deployed in Afghanistan have divisional air defence regiments equipped with SA-8s. These units, said to have fired not a single shot in anger during this deployment, were withdrawn to the Soviet side of the border in 1986.

SA-13 Gopher SA-13s with two (rather than the usual four) box launchers were seen in the airfield defence role at Kabul Airport in late 1983. During the Panjshir operations of 1984, SA-13s were photographed providing cover for a Soviet artillery battery.

ZSU-23-4 The most significant piece of anti-aircraft artillery used by the Communists in Afghanistan, the ZSU-23-4 is employed there much as the M42 40mm and M163 20mm weapons were by US forces in Vietnam, for ground support as well as air defence. In the former role it seems to be limited to specific parts of Afghanistan; it has been used extensively in the area around Ghazni, for example. ZSU-23-4s also serve on convoy escorts, primarily in areas where the road must go past high ground; in these conditions the high elevation of the anti-aircraft gun is very useful in countering ambushes from positions on the heights. The Afghan Army apparently received a limited number (said to be 20, though former army officers say this is much too high) of ZSU-23-4s pre-war. At least one took part in the April 1978 *putsch*. Soviet ZSU-23-4s have formed part of the air defences of Kabul Airport since soon after the invasion. They are organic with or attached to the 40th Airfield Defence Battalion, part of the airport garrison.

ZU-23 Soviet airborne units brought their ZU-23 twin 23mm anti-aircraft guns with them to Afghanistan during the 1979 invasion, using turretless BMDs to tow them. They have also been used in static defences. It is possible that the 103rd Guards Airborne Division has re-equipped its divisional anti-aircraft regiment with SA-9s or SA-13s.

Gun trucks Extensively used by Soviet forces in Afghanistan. The Resistance – inspired by television news coverage of the Lebanon fighting – has made its own.

M-1939 37mm gun In widespread service pre-war. Used by DRA forces in static positions.

14.5mm weapons Extensively used by the Resistance. The DRA uses these weapons as a source of dismounted firepower in the defence and in the overwatch role in the offensive. The DRA Army had a number of 14.5mm weapons in single, double and quadruple mounts before the war. Many of these were turned over to or captured by the Resistance; others remain as part of the static defences of outposts and defended localities. The Soviets brought with them additional 14.5mm weapons, especially ZGU-1s, when they invaded. Serving as infantry-support heavy machine guns, these have been used in defensive positions and to engage Afghans on high crests.

The future

Soviet air defence technology seems to be advancing in an arithmetical rather than geometric fashion, with each new SAM being a follow-on to an existing design. The pace of innovation is quickening, however, with follow-ons to such relatively new systems as the SA-8 and SA-11 – in the form of the SA-X-15 and SA-X-17 – already being reported.

The introduction and deployment of laser weapons – for use on the battlefield as well as for strategic defence of the homeland – is a real possibility. This area, to which the Soviets have been devoting a great deal of research and development effort, offers the best chances of effective non-incremental change.

Technology is also driving advances in the threats that the air defences must counter. The Soviets are particularly concerned about new conventional weapons, or "precision reconnaissance-strike complexes", as they term this latest threat to the combined-arms mechanised offensive. Complex problems will be posed also by stealth-configured tactical aircraft, cruise missiles and the carrier vehicles of deep-strike systems. One long-established threat that continues to be taken very seriously is the battlefield helicopter.

Anti-tactical missile capability will be increasingly important. In the Soviet view, it makes little sense to invest heavily in defence against tactical aircraft while neglecting to provide for missiles performing the same task.

The level of technology demanded by these new threats will not be easily attained, however. A case in point is the delay in the introduction of the ZSU replacement. The steeply increasing cost of high-technology weapons will also certainly influence the force structure in future.

In the area of tactics, the lessons of the 1982 Lebanon War have yet to be incorporated in Soviet air defence practice. When they are, a typical "systems approach" will probably be followed, with both the air defences themselves and contributory factors coming under scrutiny.

Further changes in organisation may be prompted by new technology. The emergence of the *Voiska* PVO from the old PVO *Strany* could result in more efficient use of resources, though its actual impact has still to be demonstrated. This new organisation is also reflected in changes in the way that weapons systems are used. Systems

formerly used exclusively for home defence, such as SA-5, are now committed to forward battle and sent overseas. It is also likely to result in the switching of the home-defence SA-10 to the forward area, and of the forward-area SA-12 to home defence. Old Soviet air defence systems remain valid, however, and are likely to remain in service for some time. Despite their age, the SA-2 and SA-3 can still achieve a valuable degree of virtual attrition.

Unit organisation

Divisional anti-aircraft regiment (tank and motorised rifle divisions)
Total strength: 32 officers, 392 enlisted men, 24 S-60 57mm AA guns, one Flat Face radar, four Flap Wheel radars, two BRDM or BTR-60PU scout cars, 84 trucks.
One HQ battery (seven officer, 50 men, eight trucks, one Flat Face radar, two BRDM or BTR-60PU scout cars)
Four AA gun batteries (Each of five officers, 66 men, six S-60 57mm AA guns, Flap Wheel radar, 12 trucks.
One Fire Can radar and one Ranger PUAZO-6 predictor can be substituted for the Flap Wheel.)
One service battery (five officers, 78 men, 28 trucks)

The large-calibre (130mm, 100mm, 85mm) AAA regiments currently used by some Warsaw Pact nations and previously used by the USSR are organised much the same as above. The anti-aircraft regiments of airborne divisions use the ZU-23 23mm AA gun in place of the S-60, and have one less AA gun battery, no radars except the Flat Face, and fewer and lighter trucks. This organisation is being replaced by SA-6 and SA-8-equipped regiments. Three trucks per gun battery are ammunition and supply carriers and may be with the service battery.

Divisional air defence regiment (tank and motorised rifle division)
Total strength: 480 officers and enlisted men.
One regimental headquarters (60 personnel, one BTR-60PA, three SA-7/14, four signals vans, two vans, three trucks, one jeep)
  One command centre
  One HQ platoon
  One communications platoon
  One supply and service platoon
One target-acquisition battery (55 personnel, two Long Track, one Thin Skin, one UAZ-452 computer van, one maintenance van, one NBC reconnaissance vehicle, one truck, three jeeps)
  One battery HQ
  One target-acquisition platoon
  One reconnaissance platoon
  One maintenance and service platoon
One missile technical battery (85 personnel in SA-6/11-equipped units, 75 in SA-8-equipped units; three SA-7/14, six missile testing vans, 15 missile transporter trucks [plus semi-trailers if SA-6], five transloader trucks, two Ural-375 crane trucks, six GAZ-66, one jeep)
  One battery HQ
  One missile preparation platoon
  One missile testing platoon
  One missile transport/resupply platoon
  One supply and service section
Five firing batteries (each of 150 [SA-6/11] or 125 [SA-8] personnel, four launch vehicles, one BTR or BRDM command vehicle, one GAZ-66 truck, one van [SA-6/11 only], two missile transloaders [SA-8 only], two Tub Brick, three SA-7/14, one Straight Flush [SA-6 only])
One motor transport company (80 personnel, 36 trucks, four vans, three maintenance vans, 15 POL trucks, one jeep)
One maintenance company (50 personnel, seven [SA-8] or eight [SA-6] maintenance vans, eight trucks, one jeep)

Regimental air defence battery (tank and motorised rifle regiments)
Total strength: six officers, 59 enlisted men, four ZSU-23-4, four SA-9 launchers, several trucks, three BRDM scout cars.
One battery HQ (three officers, 12 enlisted men, two BRDM or BTR-60PU, one truck)
One ZSU-23-4 platoon (two pairs, one BRDM scout car for platoon commander)
One SA-9 launch vehicle platoon (two pairs, one BRDM scout car for platoon commander)
Supply and maintenance platoon (one officer, 23 enlisted men, 10 trucks)

Some Category III motorised rifle regiments may still use ZPU-4s towed by GAZ-66 trucks or ZU-23s towed by GAZ-69s in place of the ZSU-23-4s and SA-9s. SA-13s apparently replace SA-9s on a one-for-one basis (scale was six per regiment in 1987–88). Each SA-9 platoon includes one GAZ-66 truck with 20–25 reload rounds. One Dog Ear SP warning and acquisition radar was being added to each battery in the mid-1980s.

SA-2 regiment (army/front)
Total strength: 51 officers, 466 enlisted men, 18 SAM launchers, 19 generators.
One regimental HQ (eight officers, 60 enlisted men, 1 Spoon Rest radar, one Flat Face radar, one Mercury Grass communications truck, two radar control trucks, three electronics vans, one command trailer, two ambulances, one kitchen truck, eight cargo trucks)
Three SAM battalions
One technical battalion (10 officers, 115 enlisted men, two electronics vans, 12 missile reload trailers, two truck-mounted cranes, two missile checkout trucks, one kitchen truck, six propellant tank trucks, 38 trucks)

SA-2 battalion
One headquarters battery (four officers, 43 enlisted men, one Spoon Rest radar, one radar control truck, one Mercury Grass communications truck, one command trailer, one kitchen truck, three cargo trucks)
One fire-control battery (four officers, 20 enlisted men, one Fan Song radar, four electronics vans, nine trucks)
One firing battery (three officers, 34 enlisted men, six missile launchers, six missile trailers, one generator, nine trucks [six may be replaced by AT-S tractors], organised into an HQ of one officer and two enlisted men and two launch platoons)

SA-3 units are similar, but with four launchers per battery and reload vehicles instead of trailers, as well as their own dedicated radars.

SA-4 brigade (army/front)
Total strength: 145 officers, 1,100 enlisted men, 27 SA-4 launch vehicles, 27 SA-4 reload vehicles, four Long Track radars, 24 ZU-23s or ZSU-23-4s, nine Pat Hand radars, one Thin Skin radar, 135 trucks).
One brigade HQ (eight officers, 51 men, 10 trucks)
Three SAM battalions (each of 40 officers, 285 enlisted men, including one HQ with eight officers, 48 enlisted men, 8 trucks, one Long Track radar, three SAM batteries, and one AAA battery with eight ZU-23s, towed by GAZ-66s, or ZSU-23-4s)
One signals company (seven officers, 70 enlisted men, 20 trucks)
One technical battalion (10 officers, 124 enlisted men, one Long Track radar, one Thin Skin radar, 20 trucks)

SA-4 battery
Total strength: nine officers, 64 enlisted men, three SA-4 launch vehicles, three SA-4 reload vehicles, one HQ truck, two cargo trucks, one Pat Hand radar.

Egyptian SA-6 battery, 1973
Total strength: four SA-6 launch vehicles, one or more SA-6 reload vehicles, one Straight Flush radar vehicle, one Flat Face radar mounted on a ZIL-157 container truck, four ZU-23s.

SA-7/14 organisation
Each Soviet motorised rifle and airborne battalion has nine SA-7/14 launchers, normally assigned three to each company. Each motorised rifle platoon can carry four SA-7/14 rounds, one reload in each BMP or APC. The Soviets can also group all of a battalion's SA-7/14s together as an air-defence sub-unit, commanded by an NCO.

SA-12 brigade (front/army)
Brigade HQ (two or three long-range target-acquisition radar vehicles, three command/control vehicles)
Three battalions, each of
- One headquarters (one or two long-range target-acquisition radar vehicles, two command/control vehicles)
- Three firing batteries (each with one command/control vehicle, one phased-array engagement radar vehicle, two Gladiator launch vehicles, one Giant launch vehicle, three reload vehicles)

Heavy anti-aircraft artillery

Size	130mm	100mm	85mm
Soviet designation	KS-30	KS-19M2	KS-12 (KS-18)*
NATO model number	M-1955	M-1949	M-1939 (M-1944)
Year introduced	1955	1949	1939 (1944)
Calibre	65cal	56cal	55cal (52cal)
Weight (firing)	24,900kg	11,000kg	4,986kg (4,263)
Length (travelling)	11.5m	9.238m	7.049m (8.2)
Height (travelling)	3.048m	2.201m	2.230m (2.25)
Width (travelling)	3.033m	2.286m	2.250m (2.15)
Track	2.388m	2.165m	1.8m
Elevation rate	5°/sec	9°/sec	8°/sec (20°/sec)
Elevation limits	−5°/+80°	−3°/+85°	−5°/+82°
Traverse rate	15°/sec	18°/sec	12°/sec (30°/sec)
Fire control	radar (SON-9A)	radar (SON-9A)	radar (SON-9A)
Rate of fire	10–12rpm	15–20rpm	10–15rpm (15–20)
Max horizontal range	29.0km	21km	12km (16)
Max altitude	22.0km	14.5km	9.6km (12.3)
Effective range	16.5km	11.9km	8.38km
Ammunition types	Frag-HE	Frag-HE, APHE as D-10	Frag-HE, APHE, HVAP, smoke

	130mm	100mm	85mm
Muzzle velocity	950m/sec	HE = 900m/sec APHE = 1,000m/sec	HE = 792m/sec (880) APHE = 792m/sec (880) HVAP = 1,030m/sec (1,000)
Shell weight	22.4kg	HE = 15.7kg APHE = 15.9kg	HE = 9.5kg (9.75kg) APHE = 9.3kg HVAP = 5.0kg
Armour penetration	unknown	APHE = 185mm @ 1,000m	APHE = 102mm @ 1,000m HVAP = 130mm @ 1,000m
Crew	11	9	7
Mount	4-wheel outrigger	4-wheel cross	4-wheel cross
Towing vehicle	AT-T, Ural-375	AT-S, Ural-375	ZIL-157

*85mm gun figures in parentheses are for KS-18 where they differ from KS-12.

Large-calibre anti-aircraft guns may continue to equip low-readiness front-level air defence brigades. It is also possible that unit sets of these guns are held in storage for issue to SAM-equipped air defence units which have exhausted their missiles in a prolonged conflict. Such sets would be accompanied by a cadre of gun-trained reserve officers. These weapons may also be used against ground targets.

The now-obsolete Soviet heavy AAA pieces were the result of the development of basic Soviet gun design, which was improved by adapting selected foreign technology. They all featured characteristic Soviet ruggedness and simplicity and were similar to field artillery designs, using hydraulic recoil systems and fixed-charge, separate-loading ammunition.

The 85mm KS-12 was used throughout the Second World War in the anti-tank as well as the anti-aircraft role, and was the basis of the T-34/85 tank's successful gun. After the war Soviet AAA benefited from the turning of German operational and technical experience to Russian purposes and the acquisition of new technology from both enemies and allies. Later versions of the 85mm gun (the improved KS-18) and the 100mm and 130mm guns featured radar fire-control equipment copied from that received from the US under Lend-Lease, automatic shell rammers taken from the British 3.7in AAA piece, improved breech designs and higher muzzle velocities. The newer 100mm and 85mm guns retained the KS-12's anti-tank capability. Large numbers of these guns were used by both Army and National Air Defence units until 1960–62, when they were phased out in favour of SAMs. They remain in service with Warsaw Pact and foreign nations, and many are retained in Soviet reserve stocks. The Soviets had 100mm guns in Armenia as recently as 1975.

Combat usage

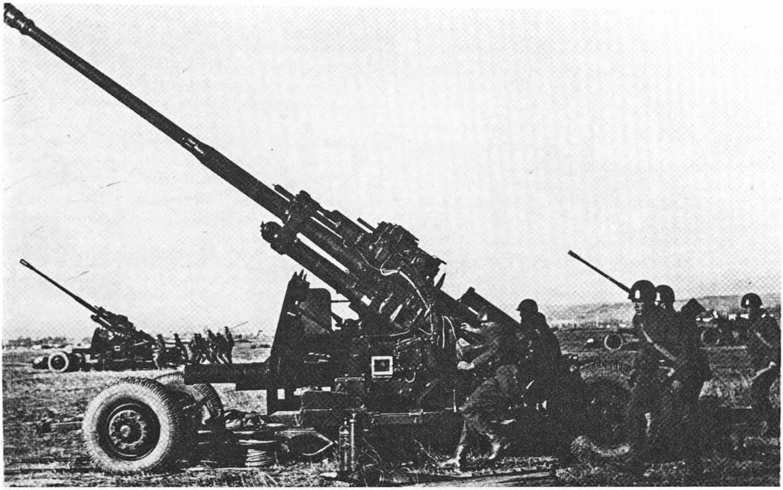
Soviet heavy AAA has seen much combat. The 85mm KS-12 was used to good effect by both Soviet and German forces in the Second World War, and 85mm weapons were the primary Communist heavy AAA in Korea. The Arabs have used these guns since the mid-1950s, but without great success. The most intense action for Soviet heavy AAA was in the defence of North Vietnam.

These are basically medium-altitude weapons. The 100mm KS-19 is most effective at ranges of 925 to 6,150m, while the 85mm KS-18 is most effective between 1,540 and 3,080m range. Effectiveness is reduced at low altitudes as a result of the difficulties of acquiring aircraft with the fire-control radar and of engaging a fast-moving aircraft with a heavy, cumbersome weapon. High-altitude effectiveness suffers from increased dispersion of shells. The 130mm gun, while impressive on paper, seems to have been a failure in action due to its bulk, much as the German Second World War 128mm AA gun proved less efficient than the "88" in many situations. The North Vietnamese may have used a few 130mm guns. Over Korea 85mm guns using radar, predictors and proximity-fuzed shells destroyed between 2% and 3% of the US aircraft they took under fire, with an average expenditure of 8,500 rounds per kill. This is similar to the performance of German 88mm AA guns in the Second World War. It is estimated that the few 100mm guns used in Korea required 7,000 rounds per kill.

Tactical employment

Intended for point defence of high-priority targets against medium-altitude air attack, these weapons protected bridges, factories, transportation bottlenecks and cities in Korea and Vietnam. The techniques for their use appear to be similar to those for the S-60 57mm AA gun.

KS-12 M-1939 85mm anti-aircraft gun emplaced in firing position, with outriggers extended. Three Frag-HE rounds are displayed on the mount. This weapon was captured by US forces near Pyongyang in 1950. *(US Army)*



KS-19M2 100mm anti-aircraft guns in action. Total Soviet inventory in 1986 was estimated at 1,800. *(US Army)*

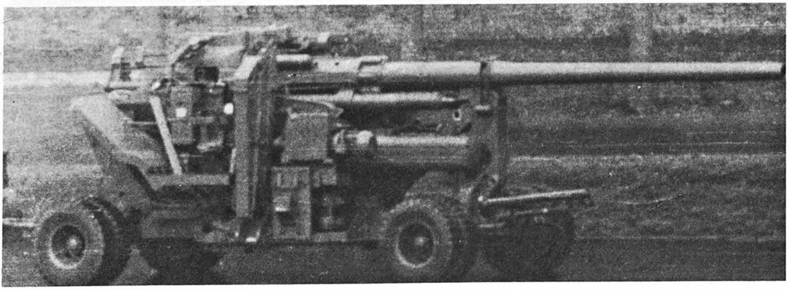
Radar network and engagement sequence

The Fire Can, Fire Wheel, Flap Wheel, and Whiff fire-control radars used in conjunction with these weapons are all derived from the US-built SCR-584 radar supplied under Lend-Lease. The SON-30 Fire Wheel was used in conjunction with the PUAZO-30 director by 130mm-equipped batteries. The SON-9 Fire Can and PUAZO-6/9 (*Pribor Upravleneya Artilleriskim Zenitnym Ognyom*, anti-aircraft fire-control device) Ranger predictor were both used with the other guns, although other radars were often substituted.

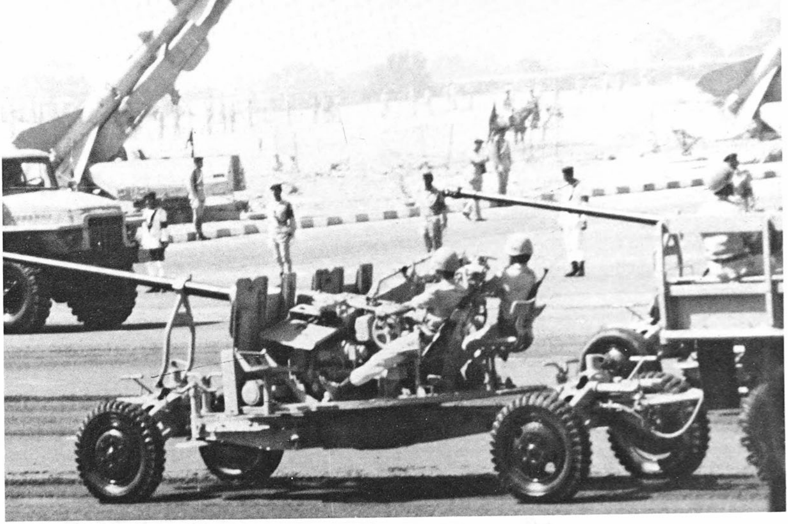
Early-warning data were provided from radars at regiment level or as part of an air-defence network, as with the 57mm S-60. The engagement sequence for the heavy AAA was similar to that of the S-60.

Countermeasures

The fire-control radars of the Soviet heavy AA guns were consistently jammed by US aircraft over Vietnam. Chaff and the entire series of ECM pods, starting with the ALQ-71/72, were effective against them. The weakness of their radar network in an ECM-heavy environment contributed to these weapons becoming obsolete.



KS-30 130mm gun. *(Chris Foss)*



57mm S-60s of the Egyptian Army, towed by Ural-375s, parade on October 6, 1976. Flap Wheel, with a traverse rate of 40°/sec, is the standard S-60 radar. *(Defence Intelligence Agency, via Virginia Mulholland)*

S-60 57mm anti-aircraft gun

Calibre	71cal
Weight (firing)	4,600kg
Length (travelling)	8.5m
Height (travelling)	2.37m
Width (travelling)	2.05m
Elevation limits	−4°/+87°
Fire control	radar
Rate of fire	105–120rpm cyclic, 70rpm practical
Max horizontal range	12.0km
Max altitude	8.8km
Tracer burnout	5.4–6.1km
Effective range	6.0km (radar control) 4.0km (visual control)
Ammunition types	OR-281 HE/HEI, BR-281 APC/API
Muzzle velocity	1,000m/sec
Shell weight	HE/HEI = 2.8kg APC/API = 3.1kg
Armour penetration	APC/API = 106mm @ 1,000m
Feed	automatic, 4-round clips
Unit of fire	200 rounds
Crew	7
Mount	4-wheel outrigger
Towing vehicle	Ural-375
Avoidance radius	5.5km

An excellent basic design still in front-line service with the Soviet Army and throughout the world, the S-60 is thought to have been copied directly from the German 55mm *Flak Gerät 58* prototype captured in 1945.

Replacing the 37mm M-1939 in Soviet service, the S-60 normally uses off-carriage radar fire control, although it retains an on-mount reflex sight for anti-aircraft use and a telescopic sight for ground targets. While it can fire from its wheels, these are usually raised and the carriage supported by four screw jacks for greater stability. Total Soviet inventory was put at 2,000 in 1986.

Combat usage

The S-60 has seen combat in the Middle East and throughout Southeast Asia. In Vietnam it was the keystone of North Vietnamese low-altitude air defence and was most effective between 460m (1,500ft) and 1,540m (5,000ft). Effectiveness has been increased by the introduction of a proximity fuze for the 57mm round in recent years, and it is thought that this is intended for use against missile-firing helicopters. A single direct hit by a 57mm round will destroy most tactical aircraft, but a proximity fuze detonation will only produce fragmentation damage, although its effects would probably suppress a helicopter's missile-firing capability. When engaging modern jet

aircraft an S-60 will have to fire approximately 8,500 rounds for each kill scored. S-60s have been used against ground targets in the Iran-Iraq war. During the US 1986 raids on Libya, S-60s were seen blazing away in panic firing.

S-60s were deployed to Afghanistan with the motorised rifle divisions that crossed the border in 1979. There have been no reports of them being used, Iraqi-style, in the artillery role. By 1986 they had been replaced by SA-8s, which were then "withdrawn" across the Soviet border.

Tactical employment

The main mission of the S-60 is airfield defence. Airfields throughout Eastern Europe have S-60s to back up their SA-3s, and other point targets are defended with these weapons.

Despite increasing reliance on SAMs, the S-60 is still a standard divisional air-defence weapon in the Soviet Army. The S-60s of the divisional anti-aircraft regiment protect regimental and battalion assembly and deployment areas along with headquarters and lines of communication, especially such vulnerable points as truck convoys, bridges and defiles. The S-60s also cover the movement of the division, either from overwatch positions (displacing as required, often by night) or while on the move. They also assist in the Stalingrad-like aerial blockade of surrounded enemy units. The S-60 is relatively large and unprotected. As it is towed by trucks it will seldom be employed closer than 10 kilometres from the forward edge of the battle area.

The S-60s are usually kept under the operational control of the divisional anti-aircraft regiment, and are not attached to tank or motorised rifle regiments. Batteries are normally positioned four to five kilometres apart, providing interlocking coverage. An S-60 battery can cover 13km², while a full regiment defends 30km². A different formation is used when the division is in route column. Each battery may be split into two three-gun platoons, 2–3km apart along the line of march. A battery in this formation protects 7–8km of the column, while the full regiment protects 30km.

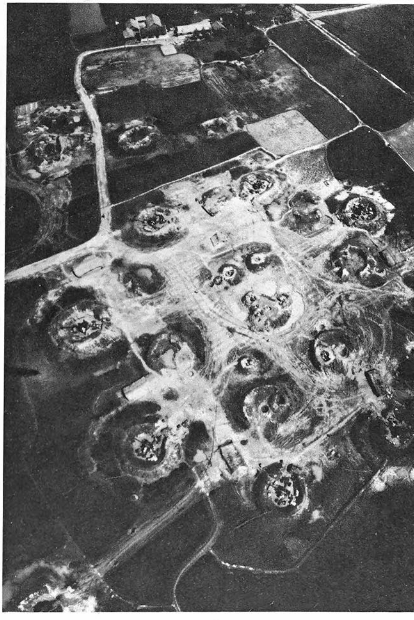
The S-60, unlike most towed AAA, can perform air-defence tasks while moving because of the speed at which it comes into action. An S-60 can be in action, firing from its wheels, within five seconds of warning. Within 20sec it can be in action deployed on the ground for greater stability. For a full battery to be in action with its predictor requires 10–14min; for guns, predictor, generator and radar to be completely emplaced and ready for action takes 25–30min. The Soviets realise that firing without complete preparation degrades accuracy, but that the mobile conditions prevalent on the modern battlefield mean that the S-60 will fire on its wheels most often.

A S-60 battery in action would take up a circular formation with the radar outside the circle, or a "V" with the radar at the apex.

In North Vietnam or Arab nations the employment of the S-60 differed from Soviet practice. They were normally used in a static role, frequently with fortified firing positions, and as an integral part of the national air-defence forces. As the primary point-defence AA guns, S-60s ringed any target of value. The Iraqis used S-60s against Iranian air and, especially, ground targets in 1980.

Radar network and engagement sequence

Each S-60 battery has either an SON-9 Fire Can radar which provides fire-control data in conjunction with a PUAZO-6 Ranger predictor, or one Flap Wheel radar which functions as both radar and predictor. Recently Flap Wheels have been retrofitted with a low-light TV camera, for use in ECM conditions, and an IFF



Right A revetted North Vietnamese eight-gun S-60 57mm battery. The radar is emplaced at the lower left. The absence of trucks or reload vehicles shows this to be a static, air-defence site. *(US Air Force)*

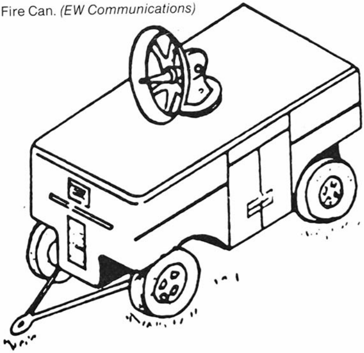
interrogator. Each Soviet divisional anti-aircraft regiment has a Flat Face radar for target acquisition and IFF interrogation. Even outside the Warsaw Pact, the Fire Can system is being replaced. In North Vietnam and Arab nations the national air defence forces' radars would provide early warning.

Once a target has been detected by either the Flat Face or army-level radars, the alert and primary target-acquisition data are passed over the air-defence radio network or landline. The S-60 battery fire-control radar uses this information to acquire the target itself and passes fire-control data to the predictor, whose computer determines the aiming point for each gun. Operation is automatic when the complete radar-directed fire-control system is used. The guns are trained and fired from central fire control, the crews simply loading fresh ammunition clips. Batteries normally fire together in bursts of two rounds per gun, shifting targets as required. After about 50 rounds at its maximum rate, the S-60 requires three minutes to cool off.

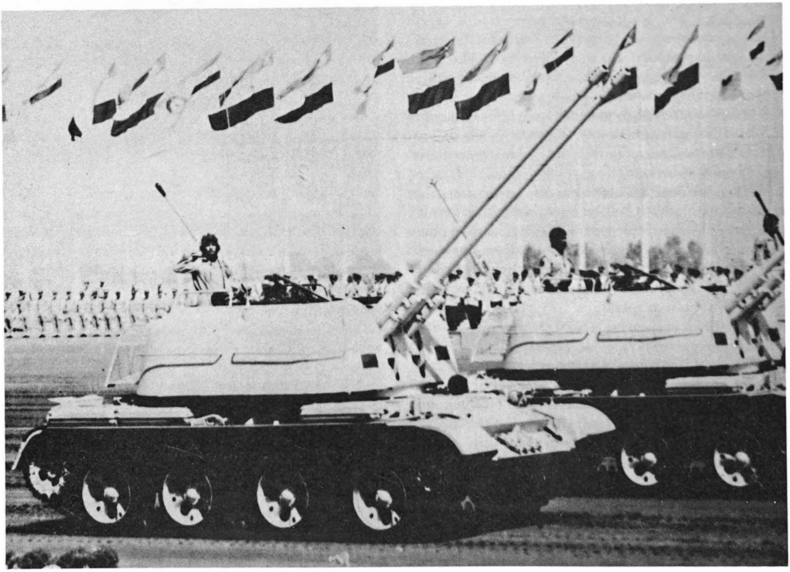
Countermeasures

The E-band fire-control radars used with S-60s in Vietnam and the Middle East have been successfully jammed by chaff and US-built ECM equipment. As a result, S-60 batteries were frequently forced to use visual fire control. US ECM equipment such as the AN/ALQ-67 pod can pre-detonate the VT fuze of the S-60 round.

Fire Can. *(EW Communications)*



ZSU-57-2s of the Egyptian Army parade in 1965.



ZSU-57-2 anti-aircraft gun

Introduced	1957	**Engine**	V-12 diesel, 520HP
Weight	28,100kg	**Armour (glacis)**	13.4mm/58.8°
Length	8.48m	**Armour (rear hull)**	10.6mm/45°
Height	2.75m	**Armour (upper hull)**	13.6mm/0°
Width	3.27m	**Armour (lower hull)**	13.8mm/0°
Ground pressure	0.63kg/cm^2	**Armour (turret)**	13.5mm/curved, all-round
Max road speed	48km/h	**Basic load**	316 rounds (264 in clips)
Fuel capacity	812lit + 400lit auxiliary	**Gun elevation**	−5°/+85°
Range	420km, 595km with auxiliary fuel	**Fire control**	optical mechanical computing reflex sight
Fording	1.4m	**Max traverse rate**	30°/sec
Gradient	30°	**Max elevation rate**	20°/sec
Vertical obstacle	0.8m		

Other armament data as S-60 (visual fire control)

The ZSU-57-2 is simply two S-60s in an open-top turret mounted on a lightened T-54 hull and chassis with thin armour and one less road wheel per side than the tank. The S-68 57mm gun mounted on the ZSU-57-2 is identical to the S-60 except that it cannot use radar fire control and the right-hand gun is modified to be loaded from the right (otherwise its feed would be blocked by the other gun). It appears that the ZSU-57-2 was never produced in sufficient quantities to equip all tank regiment anti-aircraft batteries, as originally intended.

The Chinese have produced the Type 80, a copy of the ZSU-57-2 using the Type 69 tank chassis. Production probably began in the mid-1980s.

Combat usage

The ZSU-57-2 has seen combat in the Middle East and Southeast Asia, and has been considered a failure. While basically as effective as two visually controlled S-60s, the ZSU-57-2 lacks the accuracy and all weather capability that radar fire control provides. The optical sights are apparently inadquate, crew members have been seen standing on the back of these vehicles using optical heightfinders. Some later-production ZSU-57-2s have improved on-vehicle rangefinders, identifiable by two ports in the upper forward portion of the turret front. Fire control is by an on-vehicle optical/mechanical computing reflex sight; off-carriage radar fire control cannot be used. The effectiveness of visual-only medium-calibre anti-aircraft artillery against fast-moving aircraft and helicopters "popping up" is limited, especially in European weather conditions. The large, open turret of the ZSU-57-2 makes it very vulnerable to artillery fire.

Although vulnerable to fragments and small arms – one reason it is not used in Afghanistan – the ZSU-57-2 remains effective as a direct support weapon. The Syrians used it in this role at Sidon, Lebanon, in October 1976.

A US Army study has determined that the ZSU-57-2 has a single-burst (four rounds per gun) kill probability of 48% at 1km, 14% at 1.8km and 2% at 3km against the AH-1 attack helicopter.

Tactical employment

The ZSU-57-2 was originally intended to perform the role now filled by the ZSU-23-4; close cover for advancing armoured forces. The ZSU-57-2 differed in having a better direct-fire capability against ground targets as a result of its larger guns. Unlike the ZSU-23-4, the ZSU-57-2 served only in the regimental anti-aircraft batteries of tank regiments. It is now relegated to some low-readiness units and reserve storage in the Soviet Army, although some remain in use elsewhere. Total Soviet inventory was put at 240 in 1986. The ZSU-57-2's 57mm round, like that of the S-60, is designed for tracer burn-out at 6.4km range and self-destruct at 8km.

M38/39 37mm anti-aircraft gun

Introduced	1938	**Ammunition types**	Frag-HE, AP-T, HVAP
Calibre	70cal	**Fire control**	optical-mechanical AZP-37 sights
Weight (firing)	2,100kg	**Shell weight**	Frag-HE = 0.74kg AP-T = 0.77kg HVAP = 0.62kg
Length (travelling)	6.16m	**Muzzle velocity**	HE = 880m/sec AP = 880m/sec HVAP = 960m/sec
Height (travelling)	2.7m	**Ammunition feed**	5-round clips (2-clip capacity)
Width (travelling)	1.7m	**Armour penetration**	AP = 46mm @ 500m, 38mm @ 1,000m
Track	1.545m	**Crew**	8
Elevation rate (max)	22°/sec	**Mount**	4-wheel, 2-axle trailer
Elevation limits	−5°/+85°	**Towing vehicle**	light truck
Traverse rate (max)	61°/sec		
Rate of fire	180rpm maximum 80rpm practical		
Max horizontal range	8km		
Max altitude	6km		
Effective range	3km		

37mm M38/39 in travelling position, as captured by the US Army in Korea in 1950. *(US Army)*

The M38/39 is an old Bofors-type design, widely used in the Second World War. With only optical sights and incapable of using the radar fire control needed to engage modern high-speed aircraft, the M38/39 was replaced by the S-60 in Soviet divisional anti-aircraft regiments, though some may remain for training.

Combat usage

Robust and simple, the M38/39 has been widely used. It was the main Soviet light AA piece in the Second World War, filled the same role in Korea, and was the Viet Minh's main weapon against French air power at Dien Bien Phu. Arab nations have used the M38/39 since 1956, and the gun has seen combat in small wars and insurgencies throughout the world. Like all Soviet-built AAA, it saw heavy use in Southeast Asia, both in North Vietnam and elsewhere. USAF aircrew in 1972 thought that the M38/39, despite its age, was at least as much a threat as the more modern S-60, especially as ECM had cancelled out much of the advantages of the S-60's radar fire control by then. The M38/39's higher muzzle velocity made evasive action difficult, and its higher rate of fire gave its barrages greater weight. Most effective under 420m (1,400ft) range, it required an average of three hits to destroy an F-4 Phantom or similar aircraft.

Tactical employment

The Soviet and Warsaw Pact armies used the M38/39 in much the same way as the S-60 is used today. Elsewhere, owing to its relatively large size and towing vehicle, it has been used in fixed positions, defending lines of communications and rear areas. The North Vietnamese lost most of those they had hand-carried into South Vietnam before 1972. Like the S-60, they are frequently used for close-in defence of airfields, SAM and radar sites, and similar targets. In North Vietnam a battery of M38/39s would often be dug in on a retaining dyke around a paddy field, which the Americans were reluctant to bomb for political reasons.

Engagement sequence

A 37mm battery would be warned of the direction of approaching enemy aircraft by communications from radar sites or lookouts. Each gun would normally be aimed and fired individually, although in the Second World War a mechanical predictor was sometimes used. Fire would be massed, the whole battery engaging individual targets.

ZSU-30-2 anti-aircraft gun

Weight 36 tonnes **Length** 7.8m (chassis only) **Width** 3.34m **Height** 2.85m (travelling), 4.0m (combat) **Crew** 4 **Engine** diesel, probably 710hp **Max road speed** 50km/h **Armour** light-AFV standard **NBC protection** filtration and overpressure **Guns** twin 30mm, linkless feed, 650 rounds per tube **Ammunition** HE-T, HEI-T, API-T **Elevation** $-10°/+85°$ **Max range** 9.3km (horizontal), 6.2km (vertical) **Effective range** 4.3km (radar), 3.5km (optical) **Cyclic rate of fire** 700rpm (per tube) **Muzzle velocity** 1,100m/s **Radar range** 30km search, 22km acquisition, 20km tracking **Radar type** Hot Shot K-band tracking/acquisition, E-band search **Fire control** digital predictor **Optics** low-light television, possibly laser

All figures highly approximate.

The ZSU-23-4 is the only one of the major Soviet late-1960s weapons systems not to have been succeeded by a follow-on design deployed in significant numbers. The delay suggests that the Soviets have run into the same development problems with low-altitude gun air defence that the US Army encountered on the unsuccessful DIVAD programme.

There have been unconfirmed reports of a 30mm-armed ZSU-23 follow-on for years. It was originally believed to be based on a six-barrel 30mm Gatling, but is now believed to comprise twin 30mm guns and an on-vehicle radar. The ZSU-30-2 is reported to have entered service around 1983. Its twin guns may be ballistically similar to the 2A42 on the BMP-2, while the chassis is reported to be based on that of the MT-S tractor.

There have been reports that the vehicle is based on the chassis of the T-72 rather than that of the MT-S, and that the gun is 27mm rather than 30mm.

Right Artist's impression of ZSU-30-2, showing twin long-barrel 30mm guns on a T-72 tank chassis, and fire-control and search radars. *(US Department of Defence)*

Laser air defence weapons

The Soviets are known to be developing a range of laser systems with both strategic and tactical air defence applications. The US Defence Department believes that they could be capable of deploying a short-range (3km?) air defence laser in the late 1980s. With its almost-instantaneous travel and lack of ballistic drop, the laser has great potential as an air defence weapon. But a successful development probably depends ultimately on a solution to its enormous power demands.

ZSU-23-4 and ZU-23 anti-aircraft guns

	AZP-23
Calibre	81cal
Elevation limit	−7°/+80° (−10°/+90°)
AA fire control	radar (optical reflector; ZAP-23 mechanical computing)
Rate of fire per barrel	1,000rpm cyclic, 200rpm practical
Max horizontal range	7.0km
Max altitude	5.1km
Effective AA range	3km (2.5km)
Ammunition types	Frag, HEI, API
Muzzle velocity	970m/sec
Shell weight	HEI = 0.19kg, API = 0.189kg
Armour penetration	API = 25mm @ 500m, 19.3mm @ 1,000m
Ammunition feed	two box magazines
Magazine capacity	50 belted rounds each
Avoidance radius	2.8km

(Data applicable only to the ZAP-23 cannon as mounted on the ZU-23 appear in parentheses.)

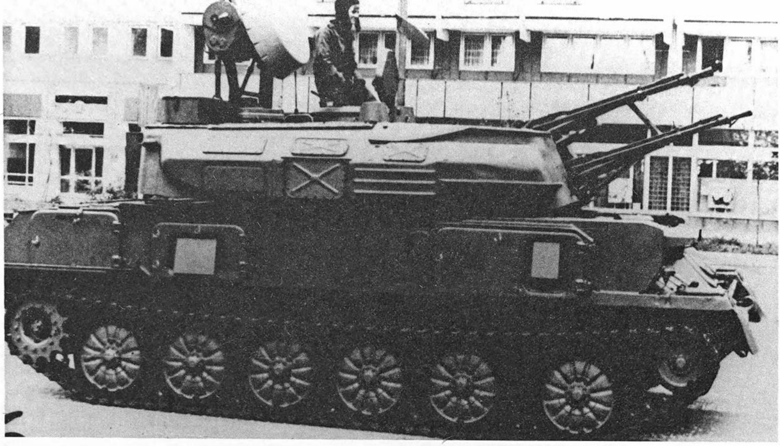
	ZU-23
Weight (firing)	893kg
Length (travelling)	4.57m
Height (travelling)	1.83m
Track	1.67m
Crew	5
Mount	2-wheel carriage
Towing vehicle	GAZ-69
Traverse rate	28°/handwheel turn
Elevation rate	19°/handwheel turn
Emplacement time	1min
Soviet nickname	*Sergei*

	ZSU-23-4
Introduced	1966
Weight (loaded)	14,000kg
Length	6.3m
Height (travelling)	2.3m
Width	2.95m
Track	2.67m
Ground pressure	0.267kg/cm²
Max road speed	45km/h
Fuel capacity	250lit
Range	260km
Fording	1.07m
Gradient	38°
Vertical obstacle	1.1m
Trench	2.8m
Engine	V-6 diesel, 290hp
Turret rotation	45°/sec
Armour (hull)	9.4mm/55°
Armour (turret)	8.9mm/15°
Basic load	2,000 rounds in 40 magazines
Time to reload	30mins
Crew	4
Soviet nickname (unofficial)	*Shilka*

The ZSU-23-4 (*Zenitnaia Samokhodnaia Ustanovka*, self-propelled anti-aircraft mount) is the most effective AAA weapons system in large-scale service today. A formidable weapon in the 1973 Middle East war, it has since occupied a crucial place in the Soviet-NATO military balance. The successful use of much of NATO's tactical air power, especially missile-firing helicopters and the USAF's A-10 ground-attack aircraft with its massive tank-killing cannon, requires that the ZSU-23-4s be neutralised or destroyed.

The ZSU-23-4 with its Gun Dish radar is a complete all-weather weapon system and a vital part of Soviet tactics. The chassis is similar to that of the ASU-85 and although it has no amphibious or snorkelling capability it does have an overpressure NBC defence system. For operating "buttoned up" the ZSU-23-4 has a land navigation system and a wide variety of vision equipment. A TPKU-2 daylight observation periscope and two BM-190 lateral viewing instruments are in the turret. At night the TPKU-2 is replaced by a TKN-1T infra-red (IR) electro-optical night vision device with a range of 200–250m. The driver is provided with a BM-130 periscope and lateral viewing instruments. A TVN-2 infra-red device and two FG-125 light elements provide night-driving capability. An R-123 radio is used for communication. The vehicle is not amphibious.

The main armament of the ZSU-23-4 consists of four AZP-23 23mm cannon, separated from the crew compartment in the turret by an armoured bulkhead. The system uses radar and optical sights and an analogue fire-control computer. There are reports of digital computers being fitted to some ZSUs. Ammunition is belted with one round of AP/API for every three rounds of HE/HEI. Both rounds have a tracer base. All 23mm



ZSU-23-4-M, reported to have digital computers and improved radar. Scale of issue may increase to six per regiment in the future.

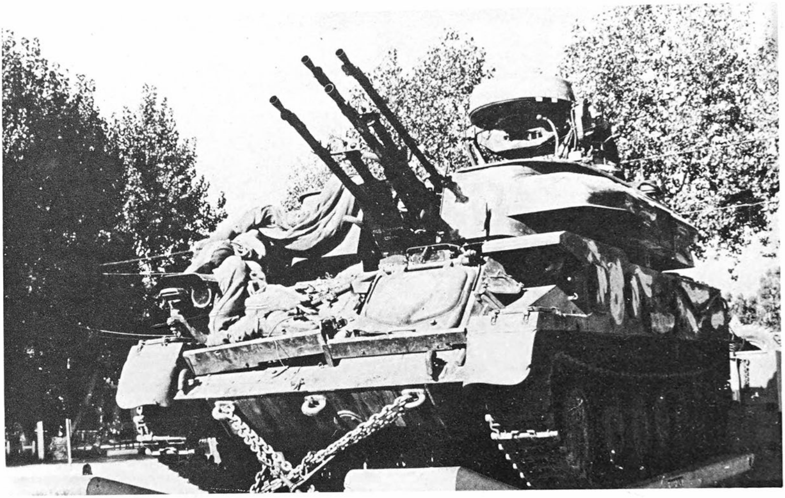
rounds self-destruct after 5–11 sec of flight, with tracer burn-out after 5sec. It is reported that only about 30% of Soviet incendiary rounds actually go off, though reliability improvements are anticipated. Explosive weight is 13g for HEI, 4.3g for HEI.

The Gun Dish radar has a moving-target indicator (MTI) which helps to distinguish moving aircraft from non-moving background, such as chaff, jamming and ground clutter. Gun Dish has a maximum surveillance range of 20km and a maximum tracking range of 18km. An azimuth gyro and a kinematic roll gyro are part of the ZSU-23-4's stabilisation circuit. A DG4M-1 turbine auxiliary power unit (APU) can provide power for the Gun Dish. Both the gun and the radar are fully stabilised and can engage targets while the ZSU-23-4 is moving at up to 25km/h, although this reduces gunfire accuracy by at least 50%. ZSU-23-4s will fire from the halt whenever possible. If used in static positions, the ZSU-23-4-M (but not earlier versions) can be linked to off-carriage radar and fire-control equipment. Later ZSU-23-4s at least have a selective-fire capability that allows the use of two or four guns together.

The ZSU-23-4 and its gun have had a number of problems. Soviet writings have mentioned rapid gun-bore deterioration caused by high rates of fire. Variation in ammunition characteristics has degraded accuracy, possibly to a great degree. A number of electrical system problems associated with the radar-controlled firing of the AZP-23 have also appeared. The most serious of these has been "runaway" firing while traversing after fire has supposedly ceased, which must be a most unpleasant experience for any vehicles or soldiers in the vicinity. To avoid such collateral damage the Soviets always try to maintain adequate spacing between ZSU-23-4s and the units they support. The AZP-23 also apparently suffers from over-heating, and it is questionable how long – probably only seconds – it could sustain even its effective rate of fire. As a result of ground clutter, the Gun Dish radar is inefficient against targets at less than 200ft altitude. This means that low-flying targets, including most missile-firing helicopters, would have to be engaged by visual fire control, which greatly reduces accuracy. The optical reflex sights, like those on all Soviet 23–57mm guns, yields 20–30-mil accuracy against 300kt targets, although higher speeds greatly reduce the precision of the fire-control solution. Gun Dish also cannot pick up small targets, and its range against aircraft with a small radar cross-section is considerably reduced. Its narrow beam permits good aircraft tracking while being difficult to detect or evade, but the chosen frequency band limits its range.

promulgated in about 1958, for an all-weather successor to the ZSU-57-2. In response, the Astrov design bureau combined the chassis of its ASU-85, a water-cooled version (AZP-23) of the air-cooled ZAP-23 23mm cannon used in the ZU-23, and the Gun Dish radar, itself probably based on the earlier Whiff.

Operational trials began in about 1964. The Model 1965 pre-production vehicles were identifiable by large cooling vents in the turret side; these were absent from the first production Model 1965, which had a modified vent. Such changes give an indication of the problems of cooling the ZSU-23-4's massive array of vacuum tubes, which have plagued the system throughout its career.



An intermediate-production ZSU-24V Model 1968 ready for shipment from Israel to the USA. *(Tom Woltjer)*

The ZSU-23-4V Model 1968 is distinguished by further minor external changes. These include deletion of the heat-exchanger from the turret roof; enlarged storage boxes on the forward turret sides; modified ejection ports; improved driver access and venting covers; and the addition of two access doors in the left-hand side of the hull. This is the version that first saw action in the Middle East and South-east Asia.

The ZSU-23-4V1 Model 1972 featured turret storage boxes repositioned amidships on the turret sides and reconfigured turret venting and hull-side access doors. This is the version that was used in the 1973 Middle East war.

The final production version was the ZSU-23-4M, also known as the Model 1977. This version is believed to incorporate the combat lessons of the 1973 war. Externally it is recognisable by the addition of a vent cover on the turret roof, reconfigured turret-side venting and storage, and the provision of a third access door on the left-hand side of the hull. More significantly, it has been reported that a digital fire-control computer has replaced earlier analogue systems and transistors in some vacuum tubes, and that the Gun Dish now has greater ECCM capability. Other improvements, affecting the IFF system in particular, were applied in 1977–83. In 1985 ZSU-23-4Ms were seen with sidelobe-reducing protrusions on the Gun Dish antenna, which also had IFF receivers on its left and right-hand sides.

ZSU-23-4 production in the Soviet Union probably stopped in about 1983. Taking into account Czech production, a total of about 4,500 examples for Soviet use and 2,000 for export were delivered.

The ZSU-23-4 will probably remain in front-line service into the mid-1990s. Its likely successor, the ZSU-30-2, seems destined to be deployed relatively slowly.

Combat usage

The ZSU-23-4 first saw action with the North Vietnamese Army in Laos in 1972, and proved itself during the initial fighting of the 1973 Middle East war. Thirty of the 80 Israeli aircraft lost in the first three days of the war fell to ZSU-23-4s when making low-level attacks on Arab armoured columns or when driven into the ZSU's kill zone while evading SA-6s, a perfect example of the complementary and overlapping system of Soviet air defence. Egypt had 125 ZSU-23-4s and Syria 96. The ZSU-23-4 underlined the continuing importance of AAA on the modern battlefield. While SAMs have supplemented AAA, they have not replaced it. On average it requires some sixteen 23mm hits to destroy an aircraft

like the F-4 Phantom, so the ZSU-23-4 must rely on weight of fire rather than pinpoint accuracy.

Although the weapon was designed for use against high-performance jet aircraft, US Army figures based on tests of captured ZSU-23-4s show that it is also extremely effective against helicopters. The probability of destroying an AH-1 Cobra helicopter gunship with a 40-round burst (10 rounds per barrel) from a stationary ZSU-23-4 is:

Range (m)	500	1,000	1,500	2,000	2,500	3,000
AH-1 manoeuvring	80%	48%	30%	18%	8%	4%
AH-1 hovering	80%	53%	36%	27%	18%	15%

A single ZSU-23-4 can theoretically fire 20 40-round bursts in a minute, so it has the potential to drive the helicopter from the modern battlefield, or at least make the elimination of its threat a first priority. As the AH-1 is heavily armoured and extremely manoeuvrable, the ZSU-23-4 would be even more effective against transport helicopters.

However, US battlefield helicopters have radar homing and warning equipment that will alert them to a Gun Dish before the ZSU-23-4 is aware of the helicopter, even though the ZSU-23-4 can acquire targets at 20km and track them at 8km range. Other ZSU-23-4 limitations include cooling problems (which is why fire is normally in 40-round bursts), the vacuum-tube technology of the Gun Dish and the crude momentum-wheel gun stabiliser. A drone helicopter reportedly flew five passes at 1,900m range in front of a ZSU-23-4 during US Army tests before being knocked down. While the time from initial acquisition to lock-on can be as little as six seconds, US Army trials have found that the full radar firing sequence can take 25–30sec. In one Soviet unit, ZSUs were opening fire as much as 120sec after helicopters had appeared, while the best crew managed it in 32sec. Certainly, it appears that the ZSU's "paper" effectiveness is not often attained.

The Soviets are said to be modifying the Gun Dish to allow the radar to operate at different frequencies, and improving the moving target indicator to help pick targets out of ground clutter. Other improvements, first used in the ZSU-23-4-M, allow the radar to swivel and search independently; previously it had been slaved to the gun tubes. Reports also suggest that a 100-round magazine is being introduced to replace the earlier 50-round magazines.

The US Army estimates that a 5–10 rounds per barrel burst from a ZSU-23-4 would have the following chances of hitting a stationary vehicle:

Range (m)	50	100	175	250	500	750	1,000	1,500
Chance of hit	97%	97%	97%	78%	61%	56%	47%	31%

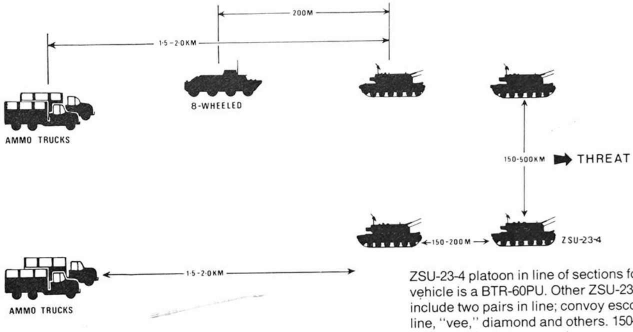
It would be unlikely to knock out a tank, and the chances of knocking out an APC depend on how many rounds actually hit. Any unarmoured vehicle caught by a ZSU-23-4 would almost certainly be destroyed.

Tactical employment

The regimental anti-aircraft battery of a Soviet motorised rifle or tank regiment includes one platoon of four ZSU-23-4s. One pair or platoon is often attached to the regiment's spearhead battalions, and the remaining ZSU-23-4s are normally within one kilometre of each other. To maintain command and control the platoon commander's BTR-60PU APC will be 200m behind the lead ZSU-23-4s. In pre-battle formation ZSUs will be positioned at 500-750m intervals. The column will not halt under air attack, so the ZSUs will fire from the move. When supporting an attack the ZSU-23-4s will follow the lead elements closely, normally at 400–500m, but less at night or in bad weather. The Soviets believe that this spacing will provide the maximum amount of air-defence cover while limiting the exposure of the ZSU-23-4s to direct-fire weapons. In this linear method of tactical employment a pair of ZSU-23-4s will be separated by 150–200m.

Ammunition trucks will follow the platoon at 1,500–2,000m. The trucks carry an additional 3,000 rounds per ZSU. In the defence the ZSUs are usually 1,000–1,500m behind the main defensive position, but may be deployed forward as part of an anti-aircraft ambush. The ZSUs will be camouflaged, with each gun assigned to cover a different sector. Radars are frequently turned off or radiation-limited. Similarly, in assembly areas or in platoon formations, only one ZSU per platoon may use its radar, reducing the chances of betraying the position.

When terrain or the tactical situation does not permit the use of a linear formation, ZSU-23-4s will form a cluster, making best use of terrain and maintaining clear fields of fire. A ZSU-23-4 platoon commander will frequently mass or redeploy his vehicles to meet an air threat, and may form echelon if threatened from the flank, with all guns facing the direction of the potential attack 200–300m from the protected tanks and APCs. During an approach march or pursuit the ZSU-23-4s are deployed along the axis of advance. They are normally near battalion HQ, although one pair is often at the head of the regiment while the other is at the tail. The ZSU-23-4s maintain a 50m minimum separation from other vehicles in the convoy to give themselves a clear arc of fire. In river crossings the ZSU-23-4s normally take up a linear position to support



ZSU-23-4 platoon in line of sections formation. Command vehicle is a BTR-60PU. Other ZSU-23-4 unit formations include two pairs in line; convoy escort in two groups of three; line, "vee," diamond and others. 150–250m between ZSUs, 1,000–1,500m between pairs, ammunition trucks 1,500–2,000m behind the ZSUs, command vehicle 200m behind. (*J. W. Loop*)

the crossing until they are ferried across one at a time on GSP ferries, ready to fire even while afloat.

The ZSU-23-4 can also engage ground targets. Its ZAP-23 would be most effective using direct fire against lightly armoured vehicles, and it is probably capable of indirect fire as well. However, its thin armour makes it vulnerable to 12.7mm machine guns, and Soviet publications repeatedly warn against "needless exposure".

Radar network and engagement sequence

With its Gun Dish radar the ZSU-23-4 is not dependent on outside fire-control radars, although it would receive information from Dog Ear or other air-defence radars over the Air Defence radio network. Gun Dish provides excellent target tracking, and is difficult to detect or evade. It can be used as a search radar.

The ZSU-23-4 has three modes of firing: radar control, electro-optical (when the radar provides range only), and optical. It primarily uses the radar mode of engagement. The Gun Dish will normally be set on surveillance or sector scan for search purposes, the area searched usually being determined by data from early-warning radars. Once an aircraft is spotted by the Gun Dish and identified as hostile by the IFF interrogator the crew switches to automatic tracking. The radar feeds the target co-ordinates directly into the analogue computer to determine the lead angle and elevation necessary to engage the target. The gun itself is automatically trained on the target. When the computer has the correct data and the gun is properly aligned, a green indicator light comes on and either the commander or the gunner can open fire. It takes about two seconds to detect an aircraft and nine seconds to lock on and fire, although some sources believe that these figures are optimistic and should be trebled.

A quicker response is possible when using the electro-optical mode, in which the crew can fire while the target is tracked by angular position, using the optical gunsight. In this mode the radar provides only the range. At one time this feature gave rise to inaccurate reports that the Gun Dish was a range-only radar.

The shortest response time is obtained with purely visually guided engagement, the gun being trained and fired using the optical sights. The Soviets believe that a ground observer will probably not see a low-flying aircraft until it is 2–5km away, resulting in reduced reaction time. Visual aiming is the least accurate method but it is the only one effective against targets at 200ft altitude or less, owing to the effect of surface clutter on the Gun Dish. Optical sights would also be used against ground targets.

Firing is normally by three five- or five ten-rounds per barrel bursts against slow-moving targets such as helicopters, or in 50-round bursts against jet aircraft. In either case all four AZP-23s would fire simultaneously.

Countermeasures

While the ZSU-23-4 and Gun Dish were known to Western military sources before the 1973 War, their precise characteristics remained uncertain. The Gun Dish proved resistant to jamming by Israeli airborne ECM equipment, and its thin pencil beam and high pulse-repetition rate compounded the lack of precise knowledge about the system. By the later stages of the war examination of captured ZSU-23-4s permitted the ALQ-119 and ALQ-101 ECM pods delivered to Israel during the conflict to be modified to jam Gun Dish. Today radar homing and warning equipment, including the AN/APR-39 mounted in US Army helicopters, can detect the Gun Dish's

emissions and give a good indication of the ZSU's direction and general location. Airborne jammers, such as the US Army's ALQ-136, and rapid dispensing of chaff are probably still effective against Gun Dish, but the Soviets have doubtless modified it since 1973. The ZSU-23-4s in action in the 1970s were affected by ground clutter when engaging targets at altitudes below about 200m.

The most effective countermeasure against ZSU-23-4s is to seek them out and destroy them. They are especially vulnerable to artillery fire, and one shell fragment through the Gun Dish's parabolic antenna will put it out of action. A ZSU-23-4 under artillery fire must retract its radar antenna into the travelling position and the crew must close hatches, making it almost impossible for them to detect an aircraft either visually or with radar.

NATO attack helicopters using TOW wire-guided anti-tank missiles will engage the ZSU-23-4s – surprising them and hitting them from the flanks, it is hoped – before attacking any other targets. The TOW's maximum range of 3,750m is greater than the ZSU-23-4's effective range of 3,000m. The US Army hopes to have its helicopters stand off at maximum range and pick off the ZSU-23-4s, then hit the SA-9 launchers, and only then start dispatching the tanks and APCs. Fixed-wing aircraft would use precision-guided munitions such as the TV-guided AGM-65A Maverick to destroy the ZSU-23-4s and SA-9s at long range, enabling aircraft using free-falling munitions or strafing to attack without having to run the deadly air-defence gauntlet.

Despite the countermeasures available to suppress or destroy the ZSU-23-4, it remains a most effective weapon system. The US Air Force estimates that to destroy a ZSU a 1,000lb HE bomb would have to impact within 3m, a 500-pounder within 1m.

ZU-23

The ZU-23 is a towed twin mount for the 23mm cannon used in a quadruple mount in the ZSU-23-4. Designed primarily for export, the ZU-23 is used in the divisional anti-aircraft regiments of Soviet Army airborne divisions. Its lack of radar fire control limits its effectiveness. It is also used in SA-4 brigades and low-readiness motorised rifle regiments. It is also used as armament for gun trucks and for airfield defence.

The ZU-23's gun barrels are air-cooled. In firing position the mount is stabilised on a three-point base, permitting rapid rotation. An optical-mechanical computing sight is used against aircraft, a straight-tube telescope for ground targets. There is also a single-barrel version of the ZU-23, probably designed to replace the ZGU-1 14.5mm gun.

The ZU-23 has seen a great deal of combat. The North Vietnamese used it throughout Southeast Asia in the later stages of the war – starting during the 1971 Laos invasion,

23mm ZU-23 captured by US forces in firing position.

Above ZU-23 in travelling position. This example was captured in Grenada. *(David C. Isby)*

when they accounted for many of the 14 AH-1s lost – and the Arabs employed large number in the 1973 War, their primary role being the close-in defence of SAM sites.

The ZU-23 was used against US forces on Grenada in 1983, accounting for two AH-1T helicopters. It has seen combat on both sides in the Iran-Iraq War, and has been used by Communist forces in Angola and Ethiopia. In the Lebanon it is often combined with a factory-made mounting kit (probably Soviet in origin) that allows it to fire from the bed of Japanese-made pick-up trucks. In Afghanistan it arms the Soviet gun-truck force. Starting in 1980 as a handful of ZIL-135s with some armour around their 23mms, this force now includes substantial numbers of ZIL-131s, KamAZ-4310s and GAZ-66s with ZU-23s positioned on the rear bed without armour protection. The Polish Army fields the ZU-23 portéed on GAZ-66s as an air defence weapon: the combination is used for training purposes and to make up ZSU-23-4 numbers.

The Chinese produce a version of the ZU-23. This weapon has been used by the Afghan Resistance, especially the *Jamiat-e-Islami* forces in the north.

Gun trucks

Gun trucks – standard Soviet Army vehicles carrying ZU-23 anti-aircraft guns – came to Western notice for the first time during the war in Afghanistan. While they have seen much action there, it is not known whether they are used by Soviet forces elsewhere.

The first gun truck to be seen in action, in 1980–81, was a modified 8 × 8 ZIL-135 with a 23mm ZU-23 on the rear decking, possibly with some local armour. There were

Below Operated by the Afghan Army, this improvised GAZ-66 gun truck is armed with a single 12.7mm DShKM heavy machine gun. GAZ-66s with ZU-23s have been used in Afghanistan and the Middle East and by the Polish Army *(US Department of Defence)*

probably only one or two batteries of these guns at most; they were seen in Kandahar and Kabul.

The gun-truck ZIL-130, with unarmoured ZU-23, is the most commonly used in action. The mount appears similar to that seen on gun trucks in Beirut.

Gun trucks appear to be most heavily used on the Salang Pass supply route between Kabul and the Soviet Union, and on the main road between Kabul and Jalalabad. Both are overlooked by mountains, making the high elevation of the ZU-23 especially useful.

A gun-truck version of the KamAZ-5320 was seen in action in 1986.

Other 23mm-armed gun trucks currently in use include GAZ-66s (Polish Army and Sandinista Army, the latter using them for air defence rather than convoy protection) and KamAZ-4310 (in extensive service in Afghanistan by 1986).

ZPU-4 14.5mm anti-aircraft gun

Calibre	93cal
Weight (firing)	1,810kg
Length (travelling)	4.48m
Height (travelling)	2.10m
Width (travelling)	1.67m
Elevation limits	−19°/+90°
Fire control	ZAPP-4 mechanical computing, reflex optical (AA); telescopic (ground targets)
Traverse/elevation	24°/handwheel turn
Rate of fire (per barrel)	600rpm (cyclic) 150rpm (practical)
Max horizontal range	7km
Max altitude	5km
Effective range	1.4km (2km against ground targets)
Ammunition types	AP-I, API-T, I-T, AP-T, HEI
Muzzle velocity	1,000m/sec
Shell weight	0.065kg
Armour penetration	API = 32mm @ 500m, 19mm @ 1,000m
Crew	5
Feed	drum magazine
Magazine capacity	150 rounds, linked belt
Unit of fire	4,800 rounds
Mount	4-wheel, 2-axle trailer
Towing vehicle	GAZ-54, GAZ-63, GAZ-66

Right ZPU-4 deployed in firing position, outrigger arms extended. *(US Army)*

Other weapons in series (where different from ZPU-4)

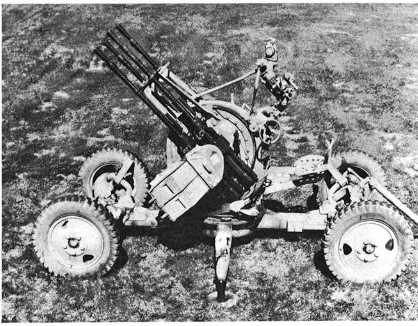
ZPU-2

Weight	994kg (travelling, early version) 649kg (travelling, late version) 639kg (firing, early version) 649kg (firing, late version)
Length	3.536m (early) 3.871m (late)
Width	1.92m (early) 1.372m (late)
Height	1.83m (early) 1.097m (late)
Elevation/depression	+90°/−7° (early) +85°/−15° (late)

ZPU-1/ZGU-1

Weight	413kg 140kg (ZGU-1, firing) 165kg (ZGU-1, travelling)
Length	3.44m 2.93m (ZGU-1)
Width	1.62m
Elevation/depression	+88°/−8°

The ZPU-4, ZPU-2 and ZPU-1 are respectively the quadruple, twin and single anti-aircraft versions of the basic Soviet 14.5mm KPV heavy machine gun. Dating back to the Second World War, the KPV is a most effective weapon for its size. Many US helicopter pilots in Vietnam considered the ZPU to be their most dangerous opposition. Smaller weapons were usually ineffective, and larger ones more cumbersome and easier to spot and destroy – so much so that even today some believe the ZPUs to be more deadly than the ZSU-23-4. On the modern battlefield, what can be seen can be destroyed. The ZPUs, though



aged, may still be effective. Some of the ZPU series can be dismantled and carried manually where larger weapons cannot go, permitting effective "anti-aircraft ambushes". There is also an obsolescent self-propelled version of the ZPU-2 mounted on the BTR-152 APC, the BTR-152V. A single-barrel mountain version, the ZGU-1, is in service. The ZGU-1 is lighter than the ZPU-1, using two wheels that can be removed for firing. It can be towed or portéed.

Since the Second World War the ZPU series has seen action in Korea, in Indochina from the French involvement to the 1979 fighting, in the Middle East since 1956, and in many small wars and insurgencies throughout the world, being used by Iraqi Kurdish guerrillas and ZANU rebels in Rhodesia, for example. The ZPU-1 and ZPU-2 have been used against the Soviets in Afghanistan. The ZGU-1 and Chinese versions of all 14.5mm weapons are also in widespread use by the Resistance, supplementing the more common 12.7mm weapons in the air defence role.

When it was used by the Soviet Army the ZPU-4 equipped the regimental anti-aircraft batteries of motorised rifle regiments, being employed in much the same way as the ZSU-23-4 that has largely replaced it. Many nations continue to use ZPUs, most notably North Korea, which fields a full brigade of ZPU-4s with female crews.

Foreign use

The Warsaw Pact armies, Cuba, Egypt, Iraq, Syria and Vietnam use the full range of Soviet AAA, although the Czechs and the Hungarians often replace the ZSU-23-4 or ZU-23 with SP and towed 30mm guns.

Other users of Soviet AAA include:

Afghanistan: M38/39, 85mm, 100mm; ZSU-23-4.
Algeria: M38/39 (Chinese model), S-60, 85mm, 100mm, ZSU-23-4.
Angola: ZU-23, M38/39; 40 ZSU-23-4.

The Chinese-made Type 75 14.5mm air-defence gun is similar to the Soviet ZGU-1. This example is used by the Afghan Resistance. *(David C. Isby)*

China: The largest single user of Soviet AAA, China produces a wide range of copies of older Soviet designs. These are: Type 56 (ZPU-4), Type 58 (ZPU-2), Type 55 (M38/39), Type 59 (S-60), 85mm (KS-18), Type 59 100mm (KS-19).
Congo: 10 ZPU-4, M38/39, S-60 (Chinese-built); 8 ZSU-23-4.
Ethiopia: 37mm, other weapons, ZPU-2.
Finland: ZU-23, ZSU-57-2, S-60, ZSU-23-4.
India: ZSU-23-4.
Iran: 100 ZSU-57-2s and ZSU-23-4s, ZU-23s.
Iraq: S-60, ZU-23, ZSU-23-4.
Jordan: 16 ZSU-23-4.
Kampuchea: 14.5mm, M38/39 (Chinese-built).
Laos: 14.5mm, 37mm.
Libya: ZU-23, ZSU-23-4, S-60.
Mongolia: M38/39, S-60.
Morocco: 50 M38/39, S-60; 100mm delivered, few operational.
Mozambique: ZU-23, M38/39, S-60; 25 ZSU-23-4.
Nigeria: 30 ZSU-23-4.
North Korea: 14.5mm, ZPU-1, 2, 4, M38/39, S-60, 85mm, 100mm, ZSU-57-2, ZSU-23-4.
North Yemen: M38/39, S-60.
Pakistan: ZU-23, 57mm.
Peru: 40 ZSU-23-4.
Somalia: 150 14.5mm, M38/39, S-60, 100mm, ZSU-23-4, few operational.
South Yemen: M38/39, S-60, 85mm, ZSU-23-4.
Sudan: 80 37 mm and 85mm (both Soviet and Chinese-built).
Tanzania: 14.5mm, M38/39 (Chinese-built).
Yugoslavia: M38/39, S-60, M-44 85mm, ZSU-57-2, ZSU-23-4.

SA-2 Guideline surface-to-air missile

Year introduced	1957/58/60/62/67/68
Length	10.6/10.8/10.8/10.8/11.2/10.8m
Diameter	0.5m 1st stage 0.66m 2nd stage
Launch weight	2.28/2.28/2.28/2.45/2.24/2.28 tonnes
Mount	single
Guidance	radio command
Control method	movable tail surfaces
Fuel	solid 1st stage, liquid (nitric acid and hydrocarbon) 2nd stage
Max speed	Mach 3/3/3/3.5/3.5/3.5
Max range	35/35/44/50/50/35km
Min range	9.3/9.3/9.3/9.3/7/7km
Max altitude	28km
Min altitude	4.5/4.5/3.0/1.5/1.5/0.9km
Warhead	195kg HE, internally grooved
Burst radius	13.5m, lethal against F-4 at low altitude
Rate of fire (per launcher)	1 missile every 10–12min
Avoidance radius	16.7km
Normal launch angle	20–80°
Fire-control radar	Fan Song A/B/C/E/E/F

Multiple data refer to: SA-2a Mk 1 V75/SA-2b Mk 1 V75SM/SA-2c Mk 2 V75M/SA-2d Mk 3/SA-2e Mk 4/SA-2f Mk 5 respectively. Soviet system designations are in V750 series.

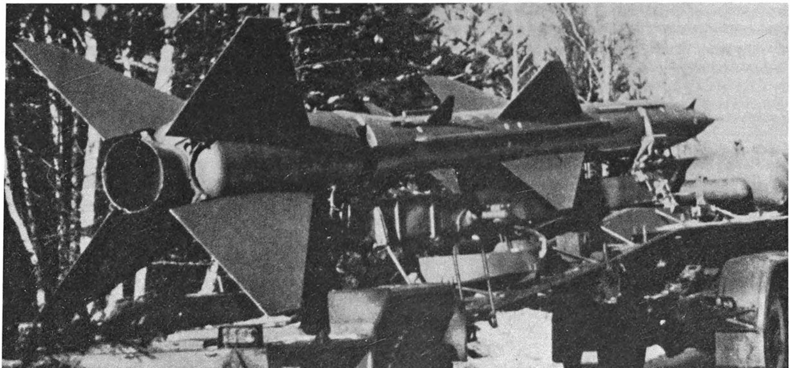
The SA-2 has had a profound effect on the development of air tactics since an example downed an American U-2 over the Soviet Union on May 1, 1960, proving the ability of the surface-to-air missile to strike even the highest-flying aircraft.

Throughout its long service the SA-2 has been improved and modified. The original "Mk 1" version had rectangular nose fins, while the "Mk 2" version, captured in the 1967 Middle East war, had delta nose fins. The 1967 "Mk 4" version, slightly longer, featured a white-painted, bulged nose cone once thought to contain a nuclear war-head. Despite its age the SA-2 has been upgraded since 1967. There are reports that the SA-2s used in the 1973 Middle East war had a terminal guidance system never previously fitted. The Fan Song F and Mk 5 version can use optical guidance techniques in an ECM-heavy environment.

The SA-2 probably resulted from a redesign of the SA-1 in 1952–3 with the aim of achieving some mobility, improving the guidance, and incorporating manual angle-tracking capability. The original SA-2 design was by the Lavochkin bureau, and development was led by Lavochkin's deputy, Pyotr Grushin. It replaced not the SA-1, which was intended for point defence of Moscow against high-altitude bombers, but rather the large-calibre anti-aircraft guns and the small numbers of German wartime SAMs deployed around key targets (and used in action against Allied reconnaissance aircraft).

Trials of the basic SA-2a Mk 1 began in about 1954, and deployment in 1957. Other versions entered service at one-year intervals. The SA-2b Mk 1 used an improved missile and was basically an interim measure preceding more advanced versions; deployment started in 1958. The SA-2c Mk 2 had further improvements and G-band radar. The SA-2e Mk 4 resulted from a substantial internal redesign: its guidance system was immune to a target scintillation problem encountered by earlier versions, and had improved ECCM capability. It was in large-scale

SA-2 Mk 2 on its trailer.



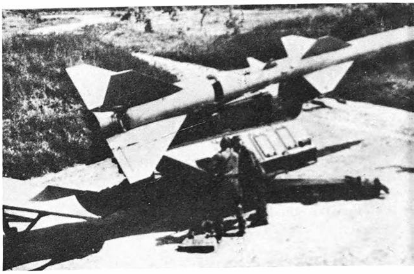
deployment by 1960. Design of the SA-2f Mk 5 apparently started in 1967, after Vietnam and the Middle East had shown up the SA-2's weaknesses at low altitude and against jamming. Prototypes flew in 1968 and deployment began in 1970.

The whole SA-2 system is very simple and "soldier-proof", built with large plugs and thick switches. In the words of one US soldier familiar with captured SA-2s: "The average 'Joe Arab' could work it with ease." This would contribute to its longevity, and it remains in service with the Soviet Army and National Air Defence Force and with many foreign nations. The SA-2 was being phased out of Soviet Army service in the late 1970s, being replaced by the SA-3 and SA-10; this process had probably still not been completed by the mid-1980s. The Soviet Union had an estimated 2,670 launchers in 1986, and the Warsaw Pact countries still deploy substantial SA-2 forces.

Combat usage

The SA-2 has seen more combat than any other SAM. Designed for use against formations of non-manoeuvring heavy bombers at high altitude, its effectiveness was demonstrated by the destruction of six high-flying U-2 reconnaissance aircraft: four over China and one each over the USSR and Cuba. This performance was obtained only at the expense of low-altitude capability and the manoeuvrability needed to engage tactical aircraft. The SA-2 is not effective at less than three kilometres altitude and it accelerates to full speed only at 7.63km (25,000ft). As with most SAMs, the SA-2 has two "dead zones" in which the missile cannot be guided. One zone, a cone above the launcher, is above the missile's performance envelope, while the other, below the performance envelope, demonstrates the difficulty of engaging low-flying aircraft coming in under radar coverage.

The Indians fired a number of SA-2s in the 1965 War but damaged only one Pakistani aircraft. The threat of the SA-2s, however, reduced the accuracy and effectiveness of Pakistani air strikes. The Egyptians fired 22 SA-2s during the 1967 War. All missed, and the Israelis captured at least one SA-2 battery.



SA-2 Mk 2 missile on its launcher. Accuracy against BQM-34 drones in Vietnam was about 10%. *(US Air Force)*

The SA-2 was used most intensively in the Vietnam War. Its accuracy rate (percentage of missiles fired yielding kills) was:
1965: 194 SAMs fired, 11 kills = 5.7% accuracy
1966: 1,096 SAMs fired, 31 kills = 2.8% accuracy
1967: 3,202 SAMs fired, 56 kills = 1.75% accuracy
1968 (Jan-Mar): 322 SAMs fired, 3 kills = 0.9 accuracy
1972: 4,244 SAMs fired, 49 kills = 1.15% accuracy
(The 1972 figures may include a number of SA-3 Goas.)

While the SAMs initially achieved a fair deal of accuracy, US countermeasures gradually reduced their effectiveness. But even then they still contributed to the integration of the North Vietnamese defence. They forced the US to divert aircraft to SAM suppression and increased vulnerability to AAA and MiG interceptors. SA-2 batteries would "spoof" aircraft radar homing and warning sets by turning on false launch signals, forcing the supposed target to take evasive action and possibly set itself up for AAA, interceptors or a genuine SA-2. Despite its lack of manoeuvrability and despite its susceptibility to countermeasures, an SA-2 popping out of an overcast can still destroy any aircraft. By 1986 over 1,000 Soviet-designed SAMs had been unsuccessfully fired at US SR-71 reconnaissance aircraft over a variety of targets. Many of these missiles were SA-2s, others were SA-5s.

Estimated cone dead zone over launcher (km)

Minimum range is:	16	14	12	8	6	10	12
At this altitude:	28.5	25	20	15	10	5	1.5

Estimated low-altitude dead zone (km)

Minimum altitude is:	1.5	2	3	4	7	10	15
At this range:	12	20	30	40	50	55	58

(Assumes dead-flat terrain.)

Only once did the SA-2 encounter the type of target it was designed to destroy. The B-52s used in the Linebacker II raids against Hanoi in 1972 were ordered to fly unmanoeuvring, direct bomb runs to avoid hitting civilian targets. Many of them were early models and their ECM had not been modernised. Even when faced with these almost ideal targets the SA-2 achieved less than 2% accuracy. Much of this inaccuracy was due to the heavy use of ECM support aircraft and large-scale defence suppression. Although this diverted aircraft away from the main bombing effort, the North Vietnamese were soon reduced to firing off salvos of SA-2s completely unguided, "like huge bottle rockets", in the words of one US Air Force officer. Were it not for the ECM of the B-52s and the intensive defence suppression, the USAF estimates that the SA-2s would have achieved 10% accuracy against the B-52s. This is still in marked contrast to the optimistic estimates of SAM accuracy made before the missiles ever saw combat; the Yugoslavs, for example, believed that their SA-2s were capable of attaining 80% accuracy.

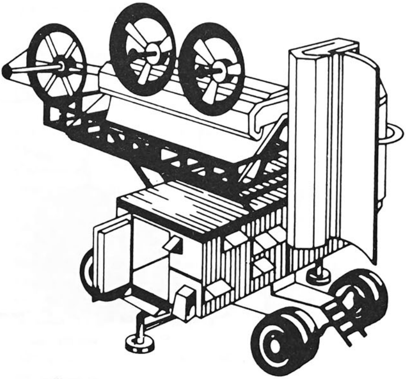
The SA-2s used by the Arabs since the 1967 War have been less effective than those used over Vietnam. Israeli aircraft flew at lower altitude than US aircraft, which was possible because Arab AAA was numerically inferior to that of North Vietnam. The Israelis soon developed effective evasive manoeuvres and bought US ECM equipment to minimise vulnerability to the missile they called "the flying telegraph pole".

Tactical employment

The SA-2s in Soviet defensive belts and those of most foreign nations are normally deployed in static positions. Some which remain in service with *Voiska* PVO have a more mobile role, and so lack permanent installations. The Soviets lay out all their SA-2 firing positions to set patterns which are also used by North Vietnam, Egypt and, presumably, most of the other nations using the weapon.

North Vietnam left many of its SA-2 sites unhardened, relying on camouflage. The launchers were simply dug into pits or left at ground level. The Fan Song radar and fire-control equipment normally remained in their vans, increasing the vulnerability of these sites to US aircraft.

In the years preceding the 1973 War the Egyptian air-defence force hardened their SAM sites. The Fan Song radar, command posts and fire-control equipment were all in deep concrete bunkers and the launchers were dug in and surrounded by concrete revetments. Communications were provided by well protected landlines. Most sites were ringed with light AAA against low-level attack. After a series of Israeli commando raids on SAM sites during the 1967–70 "War of Attrition" many sites were reinforced with a company of infantry for ground defence. These sites

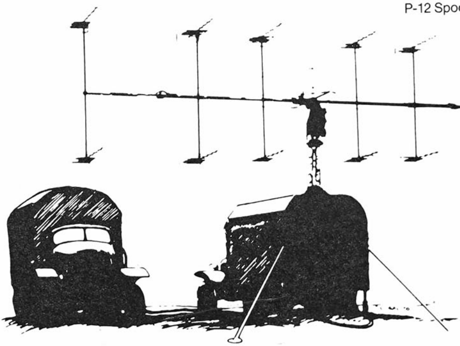


Fan Song E. Earlier versions lack the optical tracking housing on the right. *(EW Communications)*

proved very difficult for the Israeli Air Force to destroy in 1973.

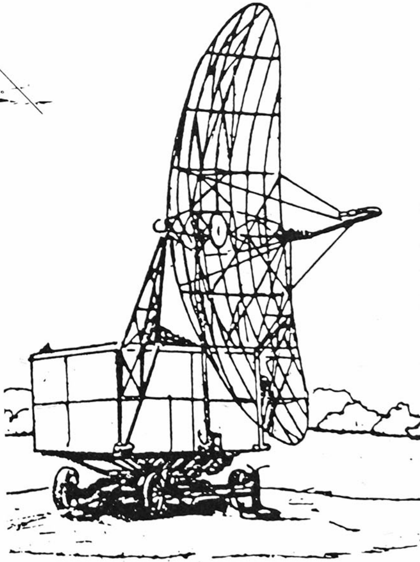
Radar network and engagement sequence

An SA-2 battery would normally be linked to a Spoon Rest early-warning radar (the North Vietnamese often used the earlier Knife Rest) and a regiment-level Side Net height-finding radar. Once these radars have acquired and identified a target, the contact is passed by radio or landline (*not* modern automatic data link) to the SA-2 battery's Fan Song radar, which tracks and acquires the target, feeding information to the battery's fire-control computer. Each Fan Song can track up to six targets and engage one with one or more missiles. All Fan Song versions can track-while-scan (tracking some targets and passing their range, speed and rate of closure to the fire-control computer while scanning and trying to acquire others), using the flapping fan-shaped radar beams from which the radar gets its name. Once the fire-control computer has sufficient data, an SA-2 can be launched, powered by its solid-fuel booster. When it is clear of the battery the booster drops away and the liquid-fuel second-stage sustainer cuts in. Once the missile is launched, the computer receives the inputs of the target's movement from the Fan Song, which is also tracking the missile's flight. The computer generates commands to steer the missile towards the target, and these are transmitted over a UHF radio beam link to four strip antennae mounted forward and aft of the missile's wings. The missile's guidance system will then adjust its course by



P-12 Spoon Rest. *(EW Communications)*

Side Net



moving the wings. An SA-2 must pick up the narrow, line-of-sight UHF beam within six seconds of launch or it will go ballistic and miss the target.

In this manner the SA-2 can be steered close enough to its target to activate its proximity fuze. The North Vietnamese overestimated the effectiveness of the SA-2's warhead against B-52s in 1972. Apparently only after American TV had shown pictures of damaged B-52s was it realised that the SA-2 must be set to explode very close to one of the big bombers to bring it down. As its circular error probability (CEP, the radius of the circle in which 50% of all missiles fired will hit) is at least 76.3m (250ft) and its burst radius is considerably less, the reason for the low accuracy of the SA-2 against even non-manoeuvring targets becomes apparent.

Countermeasures

The USA and Israel have both developed a wide range of countermeasures to the SA-2. US passive countermeasures included strike aircraft "rolling in" at 3,700m (12,000ft) to 5,500m (18,000ft) altitude, below the optimum height for the SA-2 and above the most deadly altitude for AAA, although the latter was more effective than it had been when the aircraft could fly at higher altitude. US aircraft were also obliged to spread out their formations in order to avoid the possibility of an SA-2 hitting more than one. This in turn increased their vulnerability to being "bounced" by MiGs.

Starting in 1967, a whole range of electronic countermeasures reduced the effectiveness of the SA-2. These included the USAF's ECM pods, the US Navy's internal deception jammers, and new radar homing and warning equipment such as the "Samsong." These systems were refined many times during the war. The original ALQ-71 pods, which required the aircraft using them to fly a rigid jamming formation, were supplanted by the ALQ-87 and, by 1972, the ALQ-101 and ALQ-119. Chaff also proved an effective countermeasure against SA-2s, and was dropped in quantity by flights of chaff bombers or carried in the airbrakes of US aircraft as a self-defence measure.

The Israelis relied on outmanoeuvring the SA-2 rather than using ECM against it. Once a pilot was aware of an SA-2 launch, either by radar homing and warning or visual sighting, it could almost always be evaded. The large size and the exhaust of the SA-2 make it easy to spot, especially in the clear skies and open spaces of the Middle

East. But it was deadly when fired from camouflaged sites or through clouds. To evade an SA-2 Israeli pilots would normally turn into the missile and dive under it, a manoeuvre the missile could not follow. The Israeli success in countering the SA-2 without sophisticated ECM led to the overconfident belief that later Soviet SAMs could be defeated in the same way. The 1973 War showed that they were badly mistaken.

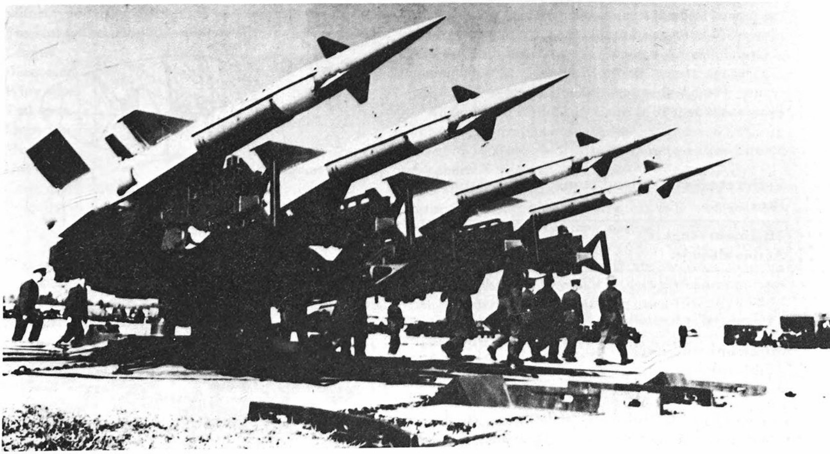
The most effective US countermeasures in Vietnam were the Wild Weasel electronic warfare aircraft and the Iron Hand SAM suppression flights. US aircraft were, for political reasons, prevented from attacking SAM sites for many months, even though their missiles were destroying US aircraft daily. But when the US finally did hit the unhardened North Vietnamese SAM sites they were often highly successful. For example, on August 11, 1967, a single flight of four Wild Weasel aircraft destroyed six SAM sites and damaged four others. In 1968 the Shrike anti-radiation missile (ARM, a missile that homes in on radiating radars) came into service. A Shrike would home on an SA-2 site in action, and the only way to avoid it was for the North Vietnamese to shut down their radars, provided they saw the Shrike coming. If they did shut down in time, any SA-2s then in flight would lose control and crash, and no more could be fired until the Wild Weasels had departed. This led to the Fan Song F of 1968, which permits optical target tracking, retaining the UHF command link. The minimum altitude with optical tracking is 100m. The SA-2f Mk 5 will also home on strobe jammers.

SA-3 Goa surface-to-air missile

Year introduced	1961 (1964)
Length	6.1m
Diameter	0.6m 1st stage 0.45m 2nd stage
Launch weight	946kg (950)
Mount	double (double or quad)
Guidance	radio command
Terminal homing	semi-active (in later versions only)
Control method	movable foreplane surfaces
Fuel	2-stage solid fuel
Maximum speed	Mach 3.5
Max range	29km (18.3)
Min range	6km (2.4)
Max altitude	12.2km (18.3)
Min altitude	1.5km (0.3?)
Warhead	60kg HE
Burst radius	12.5m, lethal against F-4 at low altitude
Rate of fire (per launch rail)	1 per min
Reload time	5min per launch rail
Avoidance radius	16.7km

Data in parentheses are for SA-3b where it differs from the SA-3a. Soviet nickname is *Pechora*, designation S-125.

Quadruple SA-3b launcher. *(V.M. Martinova)*



The SA-3 was a necessary complement to the SA-2. Designed to hit aircraft at low and medium altitudes, the SA-3 is more manoeuvrable than the SA-2 but shares its vulnerability to countermeasures. Unlike the SA-2, the SA-3 is currently in production, and new SA-3 sites are still appearing in the Soviet Union. The SA-3's increased low-altitude performance apparently includes an ability to "dive" on low-altitude targets. While its low-level capability, probably enhanced by in-service upgrades, has kept the SA-3 effective against tactical aircraft in the mid-1980s, it appears to be unable to counter cruise missiles.

SA-3 missiles are normally transported in pairs on a modified ZIL-157 or ZIL-131 truck and fired from a double, ground-mounted launcher. A more recent quad launcher is also used. This launcher was originally used primarily for the defence of targets in the Soviet Union. Since the mid-1970s it has been more widely deployed, to the forward areas to protect airfields.

Combat usage

First introduced in the War of Attrition in the Middle East, the SA-3 scored some initial successes but the Israelis soon found that countermeasures effective against the SA-2 also defeated the SA-3. The North Vietnamese first used the SA-3 in 1972, and their first kill was an F-4 Phantom that used up too much fuel evading a barrage of missiles. The SA-3 was the most numerous Arab SAM in the 1973 War but was overshadowed by the much more effective SA-6. The Syrians used a number of SA-3 batteries in the 1982 Lebanon War, suffering heavy losses. The Iraqi SA-3 force has proven ineffective in engaging Iranian penetrations. Libyan SA-3s were used against the US 1986 air strikes.

Overall, the SA-3 is more effective than the SA-2 and can engage targets below the SA-2's high minimum ceiling. The SA-3b is reported to be able to hit targets flying as low as 50m.

Estimated cone dead zone above launcher (km)

Minimum range is:	8.5	7.5	3	5	6
At this altitude:	12	10	5	3.75	1.5

Estimated low-altitude dead zone (km)

Minimum altitude is:	1.5	1.75	2.5	3.5	5
At this range:	6	10	20	30	32

Minimum arming distance is 50m. Figures for SA-3a missile.

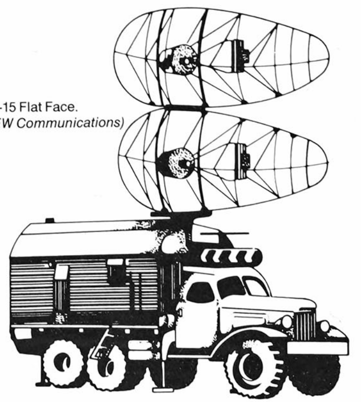
Tactical employment

Basically a static, area-defence weapon, the SA-3 is used in much the same way as the SA-2. In the Soviet Union SA-3 sites are, along with SA-5s, the basis of the strategic defence against air-breathing weapons. In forward areas SA-3s are used to defend high-value targets. Airfields are the most significant SA-3-defended locations: the SA-3 remains the standard Soviet airfield defence weapon, although S-60s and ZU-23s continue to be used, along with missiles such as the SA-13. Because SA-3 sites cannot easily displace, protection depends greatly on hardening, camouflage and the construction of dummy sites.

In 1979 there were 1,400 twin and quad SA-3 launchers deployed, with a total of 4,500 launch rails. In late 1986 the total of launchers in the Soviet Union and Warsaw Pact countries was 1,136. In the mid-1980s GSFG had about two dozen SA-3 battalions for fixed air defence. The East Germans supplemented this with about two dozen SA-2, six SA-3 and six SA-5 battalions.

Radar network and engagement sequence

Both the radar network and engagement sequence of the SA-3 are similar to those of the SA-2. The long-range early warning and target acquisition are handled by a P-15 Flat Face. In Egypt and other Arab nations Squat Eye radars are co-located with the Flat Face to provide low-altitude coverage. Both radars are usually hardened under ten feet of concrete. The Side Net radar provides height-finding information, as it does for the SA-2. The Low Blow radar organic to each SA-3 battery and its fire-control computer functions in the same way as the SA-2's Fan Song. Unlike Fan Song, however, Low Blow is optimised for low and



P-15 Flat Face. *(EW Communications)*

medium-altitude targets, and is reported to be effective in picking targets out of ground clutter. A Low Blow can track six aircraft simultaneously and guide one or two missiles to each. For operating in an ECM-intense environment, late-model Low Blow radars are coupled with a 30km-range TV camera that is said to provide the fire-control system with the same data as the radar, enabling the SA-3 to remain in action even if the Low Blow is jammed or forced to shut down by the threat of anti-radiation missiles. Fire control is still in the command bunkers; SAMs never fire under "local control".

The engagement sequence begins with searching at ranges of 83–28km, alternating five seconds of radiating with ten seconds of dummy load. Tracking of a target is performed the same way until the target is less than 28km away, when it is engaged or tracked continuously. The SA-3 cannot fire if the target is closer than 5.5km. The SA-3's first-stage booster burns out and is jettisoned after three seconds, having accelerated the missile to 730m/sec. Guidance begins at this point. The Doppler radar proximity fuze is usually activated at a range of 300m, and will detonate as soon as the target is no longer closing.

Countermeasures

Although the early USAF jamming pods and radar homing and warning equipment was not designed to counter the SA-3, the missile can be defeated by methods the same as those which defeat the SA-2.

SA-4 Ganef surface-to-air missile

Year introduced	1964 (1974)
Length	8.4m (7.8)
Diameter	0.9m
Wing span	2.3m
Tail span	2.6m
Launch weight	2,500kg
Mount	double, self-propelled
Guidance	radio command
Control method	movable forward wings
Propulsion	four solid-fuel external boosters, ramjet sustaining liquid-fuel engine
Max speed	Mach 4.0
Max range	80–100km (40km)
Min range	9.3km (7km)
Max altitude	27.4km (25)
Min altitude	100m
Warhead	135kg HE
Rate of fire	1–2 launched simultaneously
Avoidance radius	7.4km

Data in parentheses are for the Ganef Mod 1 where it differs from the initial version.

SA-4 launch vehicle

Weight	25,000kg
Length	7.8m
Width	3.2m
Max road speed	45km/h
Gradient	30°
Vertical obstacle	1m
Engine	520hp diesel, water-cooled
Track	2.66m
Track width	0.54m
Ground contact	5m
Road range	300km
Fuel capacity	500lit

While it is now being replaced by the SA-12, the SA-4 is likely to remain a significant self-propelled high-altitude SAM system into the 1990s. The Soviet Army relies on it for high-altitude protection of its forward elements.

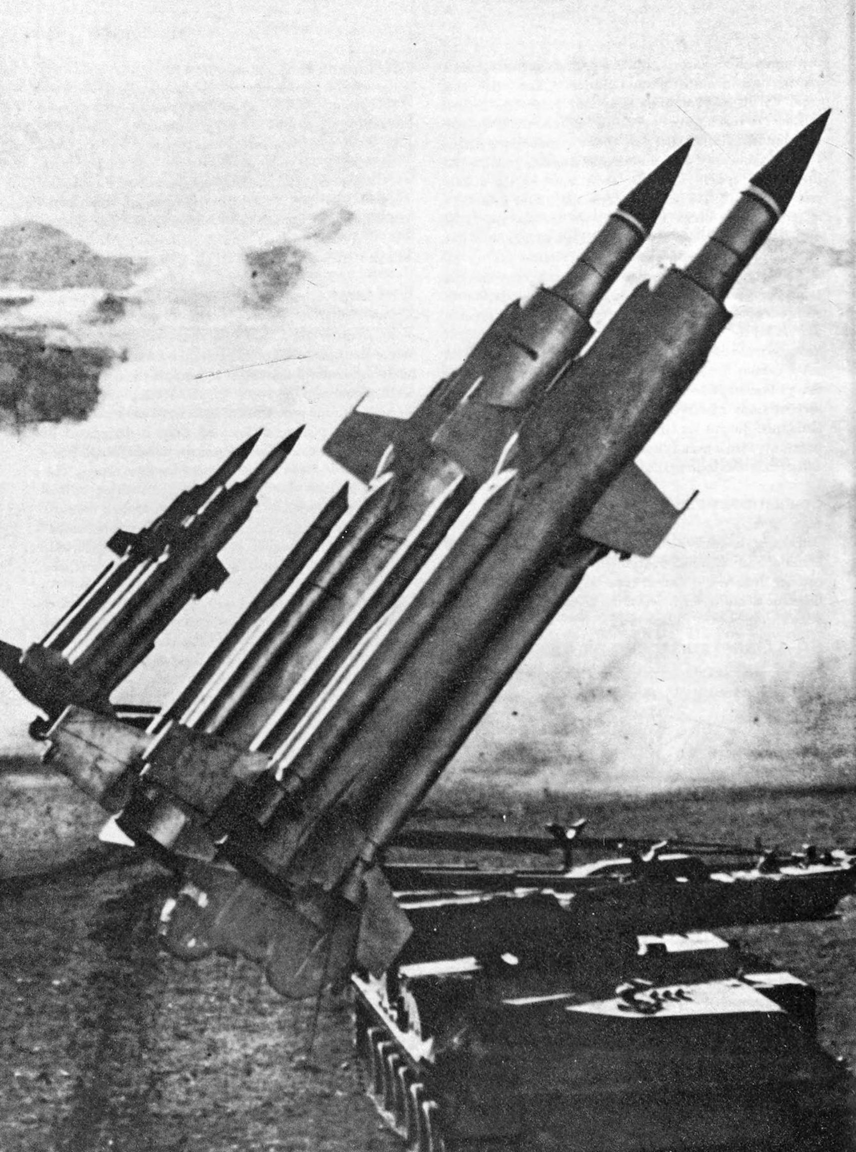
The SA-4 system, nicknamed *Krug*, is designated in Soviet service a ZRK-SD (*zenitniy raketniy kompleks — srednoye deistvie*, SAM missile system – medium range). The system comprises three elements: the SPU firing vehicle (*samokhodnaya puskovaya ustanovka*, mobile launch mount), the TZM reload vehicle (*transportnaya-zaryazhyushcha mashina*, transport-launcher vehicle) and the SSNR self-propelled radar vehicle (*samokhodnaya stantsiya navedeniya raket*, mobile missile guidance system).

The mobility of the SA-4 system comes from its tracked chassis (which is similar to that used with the SO-152 and GMZ), the use of self-propelled Pat Hand radars for fire control on the AT-T tracked chassis, and the large-scale provision of Ural-375 reloading vehicles. Three subversions of the launch vehicle, differing in minor details, have been observed: a pre- or initial production version (identifiable by its sloped hull superstructure sides), a mid-1960s version, and an early-1970s version.

An improved version, the Ganef Mod 1, was first seen in 1974. With a continuous-taper nose section and a shorter nose, this version is reported to have improved low-altitude capability.

Because this version, designated 9M8M2 by the Soviets and introduced in 1973, has improved low-level performance at the expense of maximum range (22km less) and altitude (3km less), the older SA-4a (9M8M1, introduced in 1967) remains in service. SA-4 batteries operate both variants, with three rails per battery or even one launcher per vehicle carrying the 9M8M1. It is likely that all examples of the pre-1967 9M8 and 9M8M versions have been either expended or upgraded to the two current standards.

The SA-4 has terminal radar homing. Propulsion is by four wrap-around solid-fuel boosters and a kerosene-fuel ramjet sustainer. Manoeuvres are carried out by moving the four central wings, which apparently also provide lift.



Combat usage

In 1986 the DIA estimated that there were 1,350 SA-4 launch vehicles in Soviet Army service, enough for 50 brigades, allowing at least one for each army or corps-level headquarters. Another 125 launch vehicles are used by non-Soviet Warsaw Pact forces.

The SA-4 has apparently never seen action, although some were deployed to Egypt in 1970–72. From its size, it would appear to be unmanoeuvrable and it is likely to be vulnerable to jamming, as are most Soviet SAMs and fire-control radars of similar vintage.

Some sources credit the SA-4 with a secondary surface-to-surface role. The similar US-built Nike Hercules can be used against ground targets by computing the correct trajectory and then guiding the Nike to a predetermined point in the sky. Guidance is then stopped and the missile goes ballistic on to the target. The accuracy of this method is relatively high.

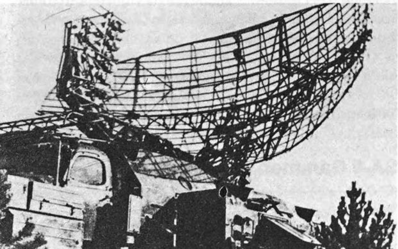
Estimated cone dead zone above launcher (km)

Minimum range is:	18.5	15	12	9.3	10	11	12
At this altitude:	18	15	10	7	5	2.5	1.1

Estimated low-altitude dead zone (km)

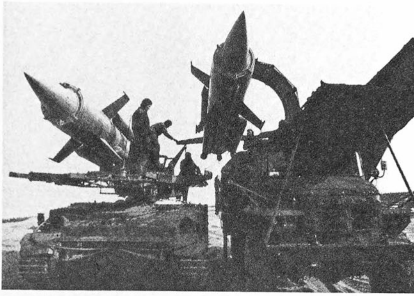
Minimum altitude is:	1.1	1.25	2.35	2.55	3	6
At this range:	12	20	30	40	50	60

Arming distance is 300m.



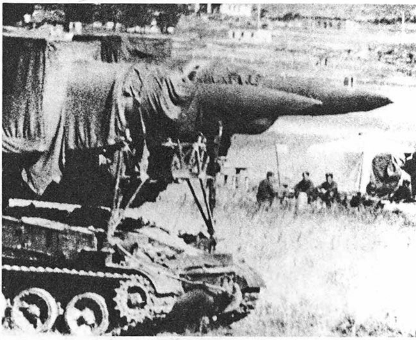
Above Long Track radar.

Left Late-model SA-4 Ganefs in firing position.



Above "Long nose" SA-4 Mod 0s being installed on the launcher with the reload vehicle's on-board crane.

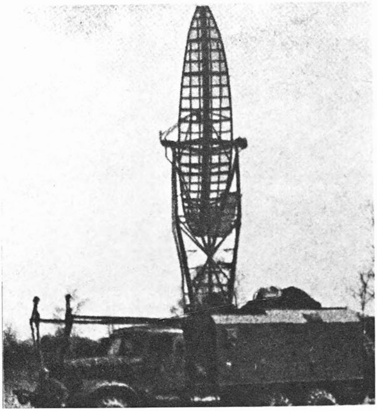
Below An SA-4 launcher at Kabul International Airport in early 1980. The shrouded shapes suggest that the launcher has one SA-4a and one SA-4b on board. *(US Information Agency)*



Tactical employment

The SA-4 is a mobile area-defence weapon used by army/front-level SAM brigades. The SA-4 batteries are positioned forward of the more static high-altitude SAM systems and provide continuous high-level coverage. The lead SA-4 battery would be 30km behind the forward edge of the battle area.

In the offensive an SA-4 brigade would probably have one battalion as close as 10km to the FEBA, with brigade HQ, and the other two batteries at 30–35km. Batteries are likely to deploy in standard diamond formation, with the Pat Hand at the rear.



Thin Skin B radar.

Pat Hand fire-control radar vehicle.

Radar network and engagement sequence

Long-range early warning is performed by a Long Track radar and an H-band Thin Skin height-finder. Pat Hand is used for battery target acquisition and fire control. Long Track is not mounted on the same chassis as the SA-4 launcher, but on AT-T tractors, unlike Pat Hand.

As the SA-4 uses a command guidance method similar to that of the SA-2, it is believed that the engagement sequence is generally similar.

Pat Hand is probably a continuous-wave radar (as is that of SA-6) rather than pulse-Doppler (SA-2 and SA-3). This, along with their different roles, suggests that SA-4 and SA-6 come from one design bureau, SA-2 and SA-3 from another. SA-4 reaction time is estimated at 10–30sec from target detection. An SA-4 battery can engage only a single target at a time, and as an SA-4 can take up to two minutes to reach its maximum range, rate of fire can be low indeed. SA-4s cannot be fired on the move.

When the Pat Hand main beam is locked on and tracking the target, the SA-4 can be launched. The signal from a transponder mounted on one of the rear fins allows the missile to be "gathered" by the command guidance beams, as with the SA-2. In the terminal stages of the engagement the four interferometer antennae on the leading edges of the forward fins pick up and home in on CW radar illumination reflected from the target until the warhead is detonated, whether by proximity fuze or command.

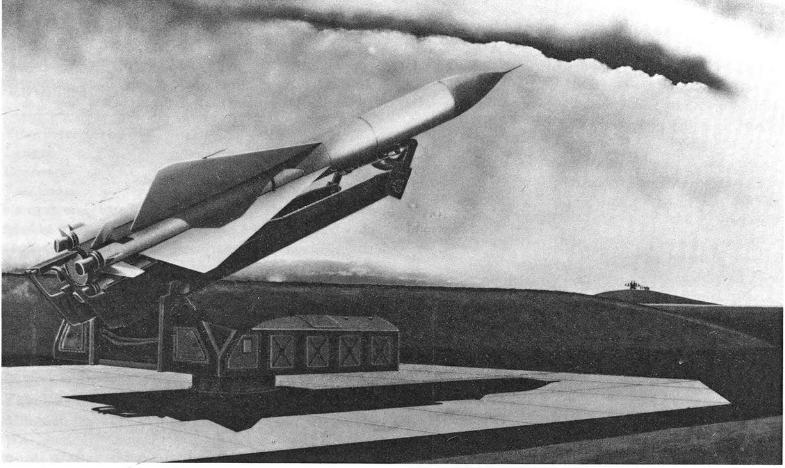
Pat Hand has the same visual guidance capability as late-model Fan Songs.

Countermeasures

Opportunities to study the SA-4 and its radar net have been limited. It has not been used in combat, and there is no evidence that the USA has acquired a specimen. However, the SA-4 Pat Hand system has been in service for a number of years and Western electronic intelligence has probably collected enough information for late-model ECM to be effective against it. Long reload times – at least 15–20mins per missile – increase system vulnerability. This accounts for the provision of eight ZU-23s per SA-4 battalion for self-defence.

SA-5 Gammon surface-to-air missile

Year designed	1959–60
Year deployed	1963–64
Length (missile)	10.6m
Diameter	0.55m
Wing span	2.6m
Launch weight	7,900kg
Mount	single, fixed
Guidance	command (terminal)
Control method	aerodynamic wings
Propulsion	solid main engine
Max speed	Mach 3.5+



An SA-5 on its single launcher. Some SA-5 sites are hardened with reinforced concrete. In 1986 the DIA put annual SA-5 production at 1,600 missiles. Soviet nickname for the system is *Volga*. *(US Department of Defence)*

Max range	300km (later versions)
Max altitude	30km
Min range	12km
Warhead	60kg HE (or possibly nuclear)
Rate of fire	1 missile every 5min
Avoidance radius	17km+
Fire-control radar	Square Pair

In the 1980s the SA-5 Gammon has taken on additional importance to the Soviet Army. With the deployment of the system outside the Soviet Union for the first time, and following the integration of PVO *Strany* into *Voiska* PVO, it is now a significant element in the Soviet theatre air defence operation. It is also a Soviet foreign policy tool: its arrival in Syria after the 1982 Lebanon War helped to repair the then strained relations between the Arab state and the USSR.

The SA-5 appears to have come from the same design bureau as the SA-1, 2 and 3, and resulted from a PVO *Strany* requirement for a high-altitude system capable of defeating bombers such as the US XB-70.

The two-stage missile has four strap-on solid boosters clustered around a single main liquid-fuelled propulsion unit. Because of the size of the missile, reload time is believed to be long. The warhead section may use active or semi-active radar guidance for terminal homing. In 1983 US sources reported the deployment of SA-5s with anti-radiation homing, apparently for use specifically against aircraft such as the E-3A AWACS and TR-1 stand-off battlefield surveillance type.

Gammon has been confused with other Soviet high-altitude SAMs seen at about the same time. These may have been either unsuccessful competing designs, or systems intended for another role, such as anti-ballistic missile defence. One such was Griffon, which resembled an enlarged SA-2. It was apparently also known as the "Leningrad SAM", following the emplacement of about 30 launchers around that city in the early 1960s to protect it against high-altitude bombers, Polaris A1 SLBMs and subsonic and supersonic cruise missiles. The Griffon left active service in the 1960s but enjoyed a longer career in Red Square parades. An upgraded high-altitude SA-2 was code-named Gaffer by NATO. It is uncertain whether it entered service.

SA-5 deployment started in 1963–5, around the city of Tallinn, hence the name "Tallinn SAM". This paralleled deployment of the Galosh ABM system around Moscow and led to the continuing uncertainty over whether SA-5 also has ABM capability. (The ABM Treaty does not however consider the SA-5 to be an ABM.)

SA-5 deployment in the Soviet Union had reached about 1,000 systems by 1970, rising to 2,030 by 1986. After Tallinn, it was deployed in barriers in European Russia. There are over 100 SA-5 sites, each with at least 12 launchers. Primary role of SA-5 is now point defence of high-value targets. Around major cities and other targets, SA-5s are usually deployed alongside four-rail SA-3

launchers, the SA-5s being tasked with high-altitude threats, the SA-3s with the remainder. While the Soviet Union does not currently face high-altitude bomber threat, it is the presence of the SA-5 that obliges the USAF's Strategic Air Command to rely on low-altitude penetration.

SA-5s appeared in Eastern Europe in the early 1980s, the first sites being near Rostock and Rudolstadt in East Germany. They were followed by others in western Czechoslovakia (first site near Plzen) and Hungary (first site east of Szombathely). By the mid-1980s there were at least six, possibly more, sites in East Germany. There are three 15-launcher sites in Syria, at Homs, As Suwayda and Dumayr; a fourth site, at Mesken near the Turkish border, has been reported. From 1983 to 1985 the Syrian sites were Soviet-manned. Libya has SA-5 sites at Oka Ben Nafi (formerly Wheelus Air Force Base) near Tripoli, Benghazi and Sirte. Only the Sirte site was operational at the time of the US air strikes in 1986. Benghazi became operational after these attacks; the status of the Tripoli site is uncertain.

Three basic SA-5 versions have been reported: the original, conventionally armed SA-5a; the SA-5b, introduced in about 1970 and reported to be nuclear-armed; and the SA-5c, believed to have been introduced in the mid-1970s and featuring dual conventional/nuclear capability and improved terminal manoeuvring. These details – particularly the nuclear capability – have never been confirmed.

There were reports in the early 1980s of SA-5s being used in anti-warhead trials, and of an anti-radiation seeker head for the missile. If no such anti-warhead capability has in fact been achieved, the SA-5 must now be regarded as an impressive but ageing system with increasingly limited effectiveness against modern tactical aircraft.

Combat usage and weapons effectiveness

The SA-5's only reported combat use was in the US–Libya fighting of 1986. A number (estimated at 8–12) were fired without result at US naval aircraft in the initial Gulf of Sirte fighting. Further rounds were fired, also without success, during the combined Navy-Air Force strikes. The system's ineffectiveness on this occasion can be ascribed to the small size of the targets, their low altitude and their intensive use of countermeasures. Elsewhere, SA-5s may have been fired at US SR-71 reconnaissance aircraft.

The most significant question relating to the SA-5's effectiveness is its ability against non-air-breathing targets. While probably designed for use against bombers, as indicated by the employment of aerodynamic surfaces for control, it may also be able to counter missiles. While this capability may originally have been similar to that of the US Nike-Zeus, it is possible that fire-control improvements have resulted in an increase in effectiveness. Should SA-5 prove susceptible to upgrading into a true ABM, the Soviets would find themselves with a substantial anti-ballistic missile system already in place.

Tactical employment

The forward-deployed SA-5s in East Germany and elsewhere in Eastern Europe appear to be aimed at large, non-manoeuvring aircraft such as tankers, AWACS, radar platforms, airborne command posts, and communications relay aircraft that would be standing off from the battle area, as well as high-level reconnaissance aircraft and bombers. The SA-5s deployed in Mongolia and exported to Syria and Libya appear to be similarly targeted.

Because the SA-5 suffers from a large volume of low-altitude "dead space," SA-3 batteries are normally co-located with SA-5 sites. It is likely that automatic anti-aircraft guns are also positioned around SA-5 sites, which are hardened in the Soviet Union.

SA-5 sites are believed to consist of 12 to 15 single launchers. Battery positions normally comprise six launchers co-located with one Square Pair radar. The missiles are sited for all-around engagement. Big Back, Back Trap and Side Net radars provide early warning.

Engagement sequence

The SA-5's engagement sequence is believed to be generally similar to that of the SA-2, with the H-band (6.62–6.99GHz) Square Pair providing fire control and the Back Net acquisition. The key difference is that SA-5 uses semi-active terminal homing. The PRV-11 Side Net is used for height-finding. An improved Square Pair was tested at Sary Shagan in the early 1970s, possibly in connection with an upgrading of the SA-5's capability against ICBM warheads. The SA-5's lack of any apparent connection with the Hen House and Dog House ABM-related radars is one of the main indications that it is not primarily an ABM. However, there were reports in the late 1970s of a newer, mobile, ABM-connected radar in development, and of improvements to the SA-5's own radar. The latter enhancements are said to have been applied to the SA-5s supplied to Syria.

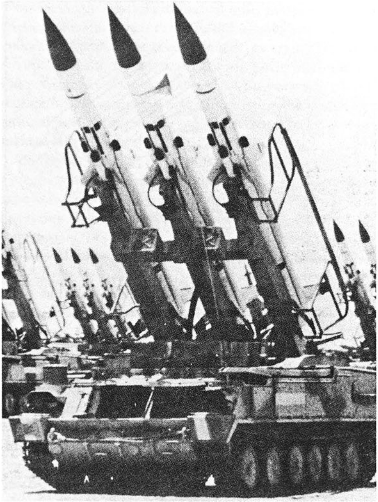
Countermeasures

The SA-5's aerodynamic control surfaces would not only limit its effectiveness against ICBM warheads, but would also render it largely ineffective against manoeuvring air-breathing targets.

SA-6 Gainful and SA-11 Gadfly surface-to-air missiles

Year introduced	1967/1979
Length	5.8m/5.6m
Diameter	0.335m/0.4m
Tail span	1.52m/1.2m
Launch weight	625kg/650kg
Mount	triple/quad SP
Guidance	radio command/semi-active
Terminal homing	semi-active radar
Control method	control surfaces
Propulsion	2-stage rocket + ramjet/solid
Max speed	Mach 2.5/3
Max range	27km/30km
Min range	4km/3km
Max altitude	12km/15km
Effective altitude	11km
Min altitude	50m/30m
Warhead	55kg/50kg
Burst radius	5m, lethal against F-4 at low altitude
Rate of fire	1–3 missiles, ripple-fired
Avoidance radius	24km or under 152m altitude
Reload time	10min/13.5min
Max acceleration	15/23g (turning flight)

Where they differ from SA-6 values, figures for SA-11 follow oblique stroke.



SA-6 Mod 0s of the Egyptian Army in firing position. An SA-6 battery can engage only one target at a time.

SA-6 launch vehicle

Length	6.8m
Height (travelling)	3.45m
Width	2.95m
Crew	3

Other data identical to those of ZSU-23-4 vehicle. SA-11 launch vehicle data similar to MT-S series.

Intended as a division-level mobile SAM system to complement the army-level SA-4, the SA-6 entered development in 1959. The system – nicknamed *Kub* ("Cube"), the missile itself being designated 9M9 – had a long and difficult development. It was not publicly displayed until 1967, and large-scale deployment probably did not start until about 1970.

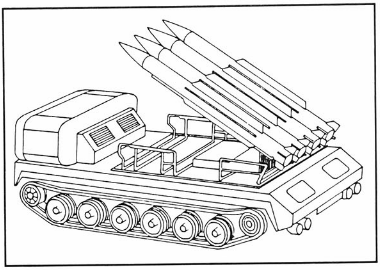
The SA-6 weapon system consists, like the SA-4, of two vehicles: a missile launcher (with three launch rails) and a radar vehicle. Both are extremely mobile. Along with the ZSU-23-4, the SA-6 was the strongest part of the Arab air defences in the 1973 War. Today it gives the Soviet Army the ability to deploy an all-weather, all-target, highly mobile SAM system close to the front lines.

The SA-6 was the first Soviet SAM system designed to defeat low-flying fighter-bombers, filling a crucial gap in the Soviet SAM umbrella, which was previously directed against bombers at high and medium altitude. This was made possible by improvements in Soviet electronics that allowed the missile's radar to detect targets in spite of surface clutter and increased manoeuvrability; this was the result of using transistors and printed circuits rather than the bulky vacuum tubes of earlier SAMs. The introduction of the SA-2 meant that aircraft could no longer fly over Soviet air defences. The introduction of the SA-6 meant they could no longer fly under them.

The chassis of both the SA-6 launch vehicle and the Straight Flush radar vehicle is similar to that of the ZSU-23-4, and shares its NBC protection, night vision equipment and lack of amphibious capability.

In 1983 the DIA estimated annual SA-6 and follow-on production at 800 rounds a year until 1990. SA-11 and follow-on production was put at 350, increasing to 600 in 1985–90.

The SA-6b Mk 1 (Soviet designation 9M9M) dates from the mid-late 1970s, and many of its details have been confused with those of the SA-11, which was emerging from development at about the same time. It differs from the standard SA-6 in having a radar on the launch vehicle, which is itself said to be a new design, possibly based on the



SA-11s on a launch vehicle based on the MT-S tractor. *(Soldat und Technik)*

MT-S chassis. On-vehicle radar allows the launch vehicle to engage targets without recourse to the Straight Flush, although the latter does provide target identification and warning. One SA-6b launch vehicle originally replaced an SA-6a vehicle in each four-launcher battery. The SA-6b missile itself is a standard Gainful with, it is believed, improved ECCM and low-altitude capability. These missiles may possibly also be used on standard SA-6 launchers. SA-6bs were supplied to the Syrians after the 1982 Lebanon War.

The SA-11 Gadfly is a follow-on to the SA-6b, using the same launch vehicle with an integral radar. The vehicle can launch either Gainful or Gadfly, though its four launch rails are sized specifically for the smaller Gadfly. It may be that the SA-11 launch vehicle and radar were available for production before the missile, and entered service in combination with the improved Gainful, pending the availability of Gadfly.

Gadfly is believed to be a land-based version of the SA-N-7, a single-stage, solid-fuel missile with semi-active radar guidance. The on-vehicle radar, believed to be a development of the SA-N-7's naval radar, handles target tracking and illumination. The size and flight patterns of the Gadfly are similar to those of the US Navy's Standard SAM system. As with many other Soviet SAMs, stolen technology features significantly in this design. Gadfly is reported to engage low-altitude targets in the same way as Standard, climbing and then diving down on them. Each four-launcher Gadfly battery also has a 3-D acquisition radar mounted on one of the launch vehicles, obviating the need for a separate mobile heightfinding radar, formerly the norm for Soviet SAM systems.

The SA-11 is reported to have been first deployed in the Turkestan Military District in late 1979. Since then, it is probable that SA-11s have been deployed in complete regiments organised like SA-6 units, which they probably replace. The first SA-11 regiments probably became operational in 1982–85 in the USSR. The type of radars used at battery and regiment level in SA-11 regiments for target acquisition and early warning has not been established. SA-11s are reported to be used for close-in protection of SA-5 sites in Eastern Europe, possibly replacing SA-3s. It is believed that the first export systems went to Syria in 1983; they are not known to have been used in action.

Combat usage

The SA-6 destroyed large numbers of Israeli aircraft during the first two hours of the 1973 War. To a large extent this was due to technological surprise. The Israelis, having developed effective countermeasures against the SA-2 and SA-3, were little worried by the SA-6 before the war. As a result they were surprised by the SA-6's manoeuvrability, low-altitude capability and especially its continuous-wave (CW) terminal radar guidance. Once the surprise wore off, the effectiveness of the SA-6 declined. By the end of the war the SA-6 had proven to be hardly more accurate than earlier SAMs. The accuracy rate was about 1.8%, with 55 missiles fired for each kill scored. Although other sources have reported that SA-6 accuracy was somewhat above the 2% average for all Arab SAMs excluding SA-7s (a 2.3% figure – 840 SA-6s fired for 20 kills – has been proposed), the SA-6 is not a wonder weapon. The Soviet introduction of the SA-8 shows that they perceive limitations to the SA-6. A large measure of the SA-6's effectiveness in 1973 was not in the aircraft it shot down but in those it forced to fly lower, into the teeth of intense Arab AAA, especially the ZSU-23-4s. The mere threat of the SA-6s prevented the Israelis from striking targets that they would otherwise have hit hard.

The tactics the Israelis evolved to defeat the SA-6 Gainful were similar to those used against earlier SAMs. When an Israeli aircraft was alerted to an SA-6 launch, it turned towards the missile in a steep diving turn. The pilot opened his airbrakes, releasing two clouds of chaff that the SA-6's terminal semi-active radar homing guidance would usually lock on to. The Israeli aircraft then dived under the SA-6 launch. The SA-6 could not manoeuvre to intercept the steeply diving Israeli aircraft, which then either proceeded to its target or hit the SA-6 launcher from its steep dive, coming in from the launcher's cone blind spot.

The SA-6 has been supplied to Polisario guerrillas. Total strength is believed to be about one battery deployed around their bases near Tindouk in Algeria. These SA-6s have shot down five or more aircraft over Morocco, and were responsible for major Polisario successes in 1981. The Algerians are also reported to have used SA-6s against

Morocco. Libya used SA-6s against Eygptian aircraft in 1977 and US aircraft in 1986. Libyan SA-6s also saw combat against French aircraft in Chad in 1986–87. They scored no kills – they were presumably countered by French electronic warfare systems, designed for European conflicts – while the French Air Force used anti-radiation missiles to great effect against the Libyan radars. Many of the surviving SA-6s were captured by Chadian forces in 1987.

The Iraqis have used SA-6s throughout the Iran-Iraq war. Syrian SA-6s constituted the bulk of the air defence forces deployed into Lebanon in 1981, and they played a major part in the 1982 war. The 22 Syrian SAM batteries knocked out in the Beka'a included many SA-6s. The Syrian air defence in Lebanon was cut off from the home air defence network's early-warning radar coverage by mountains, while anti-Syrian Lebanese forces held key heights that could otherwise have been used for long-range radar surveillance. Forced to rely on local radars placed among low hills and mountains, the Syrians were vulnerable to aircraft using terrain-masking. While many SAM sites were defended with guns, SA-7s and smoke generators, Israeli advances forced their evacuation and many batteries were hit while moving. Nonetheless, the fact that the SA-6 suffered heavy losses while killing nothing but drones does not necessarily mean that age is reducing its effectiveness.

Estimated cone dead zone over launcher (km)

Minimum range is:	17	15	11	7.5	5	(1–6)
At this altitude:	12	10	7.5	5	2.5	minimum

Estimated low-altitude dead zone (km)

Minimum altitude is:	minimum	1.75	2.5
At this range:	(1–6)	20	30

The close-in capabilities of the SA-6 are difficult to ascertain. While the minimum effective range may be as much as four to six kilometres, it has also been reported that the SA-6 can engage targets as close as one kilometre. It arms itself after flying as little as 30–50m, which would contribute to a short minimum range.

Tactical employment

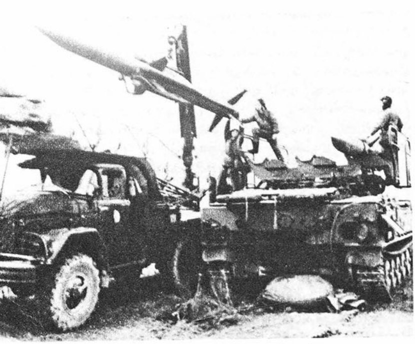
The deployment of Soviet divisional SAMs, especially the SA-6/11, gives them a substantial reach forward of the FLOT while covering all of the divisional area. This represents a great advance on the S-60, which could do neither. Polish Army SA-6s, unlike those of the Soviet Army, are non-divisional weapons, equipping independent air defence regiments.

Soviet Army SA-6s in divisional units provide low and medium-altitude area defence throughout the area of operations, relying on their mobility to keep pace with advancing units. By 1978 50% of the Soviet divisions in East Germany had received SA-6s (or SA-8s) as replacements for the S-60 57mm guns in the divisional anti-aircraft regiment. By 1980 the SA-6 was almost exclusively a division-level weapon.

On the march, SA-6 batteries will be deployed along the axes of advance, displacing in turn. An SA-6 battery can be expected to stay 30–120min in one position before displacing. A battery can set up in less than 30min and start moving in 5–10min. In the offensive, some batteries will be positioned to overwatch the first-echelon regiments, others to cover the second echelon, divisional artillery and SS-21 battalion, and divisional HQ. Thus three batteries may be forward, about 5km behind the front lines, with the remaining two 10km further to the rear. An SA-6 regimental headquarters will normally deploy its HQ elements in a rectangular 125m × 75m area, usually within 1,000–5,000m of one of its SA-6 batteries, and will stay in place for 3–5hr. It consists of two Long Track and one Thin Skin-B vehicles, an operations van, a command van and a communications van, all with the required generators. The support vehicles will be 1,000–1,500m to the rear. Commitment of the second echelon is seen as the moment of maximum vulnerability to air attack, and the batteries may be redeployed to cover this movement.

Divisional SA-6 batteries could take up line, shallow "V", diamond or box formation, with the launch vehicles 100–750m apart depending on terrain. The diamond formation – apex towards the enemy, Straight Flush in the middle – gives the best all-aspect coverage. The battery command vehicle will be close to the Straight Flush and connected to it by secure landline. The reload vehicles will be concealed 1,000–1,500m to the rear. It has been reported that on mobilisation each Soviet SA-6 divisional battery will be increased from four to six launchers, the extra units being drawn from storage; non-Soviet Warsaw Pact forces will stay at four launchers per battery.

Although SA-6 is a mobile system, it has been seen in prepared earthworks. In Syrian service the SA-6s seem to have been used in a basically static role, positioned either in the forward air-defence belt that covered the Syrian advance into the Golan or held back around Damascus. The Egyptians seemed more aware of the missile's mobility, but only two batteries advanced into Sinai because the Egyptians lacked a mobile early-warning radar. Moreover, since the SA-6s were tied into the overall national air-defence plan, it would have taken eight hours to re-integrate them in their new positions. In contrast, Soviet SA-6 batteries are required to be able to receive the order to move, displace and set up within 15min. The majority of the SA-6s held their positions in the Egyptian air-defence belt along the Suez Canal.



An SA-6 is loaded onto the launcher from the reload vehicle, a ZIL-131 truck. A total of 850 launchers were estimated to be in Soviet service in 1986.

Radar network and engagement sequence

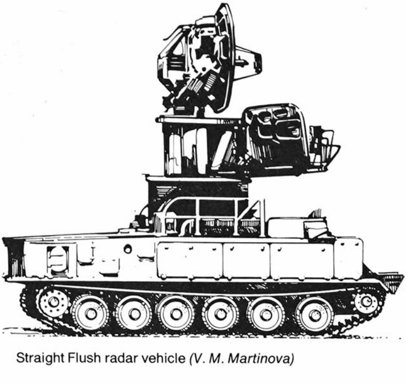
In the Soviet Army SA-6 batteries receive their long-range search, early-warning, target-acquisition and altitude-discrimination data from the Long Track radar and their associated Thin Skin height-finders. If already turned on, Long Track takes about 30sec to locate and lock on to a target; otherwise it would take three minutes. Although they received them post-war, the Arabs were not equipped with the Long Track in 1973. To compensate, the Egyptians assigned one Flat Face radar mounted on a ZIL-157 truck chassis – as used by SA-3 units – to each SA-6 battery. However, Flat Face is not a mobile radar system, and this hindered the advance of Egyptian SA-6s to cover the troops in Sinai.

The rest of the SA-6 system's radar network is self-contained in the self-propelled Straight Flush radar, which gets its name from the fact that it operates on five different radar bands. It can perform limited search, low-altitude detection and acquisition, target tracking and illumination, and missile radar command with secondary radar response for missile tracking. The same vehicle also contains the fire-control computers for the battery. Some Straight Flush vehicles have been observed with a TV camera similar to that used with the SA-3. Such cameras were not fitted to the export versions used in the 1973 war. The Straight Flush can also be linked to the SA-6 launch vehicle directly by a 100m-long cable or data link.

When a target is detected by the Long Track/Thin Skin combination (or Flat Face in Egyptian service), target data such as range, bearing, altitude, speed and rate of change are passed by radio data link to the SA-6 battery's Straight Flush radar vehicle. The Straight Flush acquisition radar, operating in the 5–6GHz band, then takes over, locating the target more accurately and confirming that it is an enemy through IFF interrogation. This is done by the pulse-Doppler method (individual pulses of radar energy) rather than continuous-wave. The fire-control system computer processes this data. The Straight Flush's G/H-band target-tracking and illumination radar, operating in the 8–10GHz band, now illuminates the target with continuous-wave radar. Israeli aircraft radar homing and warning systems, which could tell when their aircraft were illuminated by pulse-Doppler radar (as used with the SA-2 and SA-3), could not detect illumination by continuous-wave radar. This contributed to the SA-6's technological surprise effect.

Once the Straight Flush is locked on the target aircraft it will follow its movements unless the aircraft's manoeuvres or ECM throw off the radar beam. As soon as the fire-control data are complete – about nine seconds from IFF interrogation – the missiles may be fired. Total reaction time can be as little as 15sec, although this is unlikely to be achieved in combat. Three missiles may be launched against a single target by the SA-6a.

When launched, an SA-6 performs a characteristic "snake dance", weaving back and forth until the command receiver on the lower left tail fin picks up the continuous-wave command signals from the Straight Flush, while the seeker head in the missile's nose picks up reflected radar energy from the illuminated target. The missile then moves on a lead-pursuit course to intercept. All this occurs while the missile is accelerating at 20 times the force of gravity. Its integral solid-fuel rocket engine pushes it through Mach 1.5 in the boost phase of its flight, at which point the tail cone drops off and the rocket propellant chamber, now empty, becomes the combustion chamber for the ramjet engine, which brings the speed up



Straight Flush radar vehicle *(V. M. Martinova)*

to a maximum of Mach 2.8. While in flight the missile transmits G/H-band beacon signals which report its position to the Straight Flush. The fire-control computer uses these signals to generate course corrections which are transmitted by the Straight Flush. Once the SA-6 gets close to the illuminated target it will go into semi-active terminal homing, homing in on the radar reflection from the target, and the seeker head will continue its lead-pursuit course until the proximity fuze detonates.

A typical Soviet compromise in the interests of lower cost and simplicity, the mixed rocket-ramjet propulsion offers high speed, low cost (40% cheaper than a comparable liquid-fuel rocket), and two to three times less maintenance than a rocket, although the ramjet loses efficiency at high altitudes and the propulsion system cannot be throttled for different points in the envelope.

Countermeasures

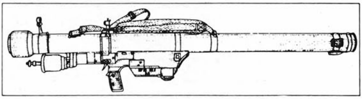
The initial effectiveness of the SA-6 was largely due to the inadequacy of Israeli countermeasures. Jamming and radar homing and warning equipment that was effective against the SA-2 and SA-3 did not work against the SA-6. According to some reports the SA-6 possessed a "home on jamming" function that actually made it *more* accurate against Israeli aircraft using older ECM equipment. Israeli radar homing and warning equipment did not pick up SA-6 launches or alert the pilot when the aircraft was illuminated. The Israelis were forced to rely on spotting the SA-6 launches visually, aided, according to some sources, by observation helicopters hovering over Israeli positions. Once an SA-6 was spotted, the target aircraft would turn sharply towards it and dive, passing under the climbing missile. Straight Flush's ability to engage targets at altitudes as low as 100m – or 50m when using optical tracking – made this a difficult manoeuvre.

This manoeuvre was normally effective but often put the evading aircraft within range of light AAA, used up a great great deal of fuel, and required the aircraft to be lightly loaded with bombs to perform such aerobatics. The Israelis also adopted the US tactic of putting chaff in their airbrakes. After the first week of the war the Israelis had learned enough about the SA-6 to modify their ECM equipment to jam it. With large numbers of ECM pods being airlifted from the USA, SA-6 effectiveness plummeted. However, Soviet technicians in Egypt and Syria worked feverishly to modify the SA-6's engagement procedures; they may have had at least a partial answer to the new Israeli ECM equipment by the end of the war. Even pod-equipped aircraft started to suffer losses. Since then, as the USA has had several SA-6s, launchers and Straight Flush radars to study, it is thought that effective countermeasures have been developed. Of course, the Soviets, knowing that the USA has been working on these countermeasures, have probably modified their SA-6s to counter them. The "wizard war" continues, with both sides searching for countermeasures and ways to counter the countermeasures.

SA-7 Grail surface-to-air missile

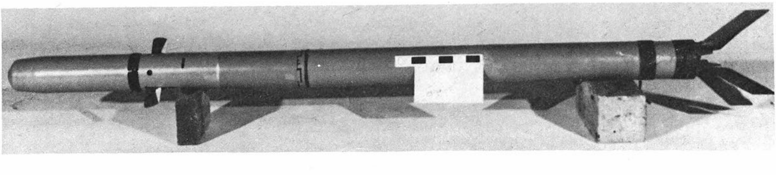
Year introduced	1966 (1972)*
Length	1.4m
Diameter	0.07m
Launch weight	9.2kg (10kg)
Mount	man-carried
Guidance	infra-red homing
Control method	canard fins
Propulsion	2-stage solid-fuel
Max speed	Mach 1.4 (Mach 1.7)
Max range	3.7km (5.6km)
Min range	600m (500m)
Max altitude	3.0km (4.3km)
Min altitude	150m (23m)
Warhead	1.2kg, including 0.37kg HE
Reload time	6sec
Soviet nickname	*Strella*-2 (*Strella*-2m)
Soviet designation	9M32 (9M32M)

* Data in parentheses relate to later "Mod 1" (or SA-7b) version where it differs from earlier versions.



Drawing of SA-7a missile tube (with sights flipped up and carrying strap attached) on its gripstock launcher. The projecting assembly at the front of the gripstock is the thermal battery. The audible alarm which gives the launch tone is at the rear of the gripstock. *(Truppendienst)*

Early-model SA-7 round, removed from its launch tube. *(US Army)*



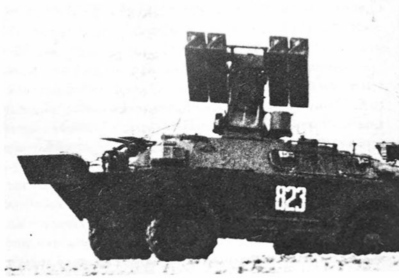
SA-7 launcher

Length	1.346m
Width	0.1m
Weight	9.2kg
Soviet designation	9P54 (9P54M)

SA-9 Gaskin surface-to-air missile

Year introduced	1968/1971
Length	1.8m
Diameter	0.11m
Span	0.34m
Launch weight	43kg
Mount	BRDM-2 scout car
Guidance	infra-red homing
Control method	cruciform canard fins
Propulsion	solid-fuel, two-stage
Max speed	Mach 2
Max range	6.5km/8km
Min range	0.8km/0.56km
Effective range	3–8km
Max altitude	5km/6.1km
Min altitude	20m/15m
Effective altitude	1.9km
Warhead	7kg
Rate of fire	1 round every 5sec
Reloads on BRDM	4 (possibly none carried)

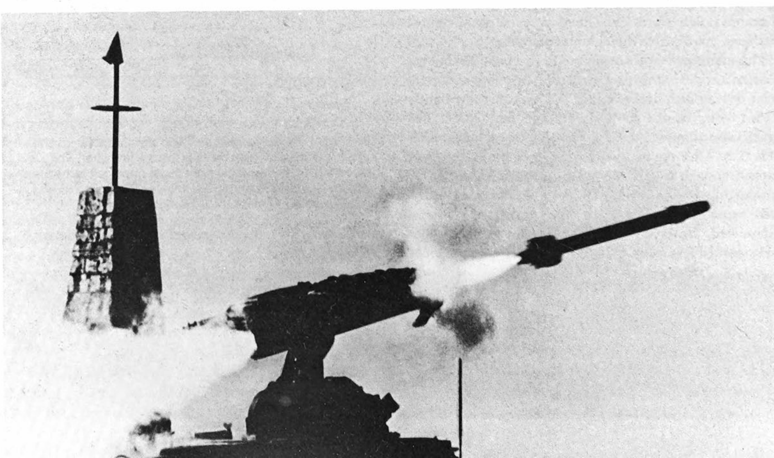
Reload time is five minutes for four missiles. Figures following oblique strokes are for the improved 9M31M version (SA-9 Mod 1) where it differs from the basic design. The Mod 1 may have a range of up to 11km when tail-chasing a target.



SA-9 launch vehicle with trim vane extended and missile canisters in firing position. The rear Hat Box receiver is visible above the aft decking. The armoured shutters for the driver's and commander's windows would be closed before a missile was fired.

The three models of the SA-7 and the larger SA-9 allow the smallest Soviet tactical units to have SAMs for self-defence. They differ from other Soviet SAMs in having infra-red homing; they home in on heat, normally that of the target aircraft's engine exhaust. Consequently, early SA-7s are usually only fired directly behind the target aircraft's tail, in its 6 o'clock "slot", which means that the aircraft must be going *away* from the gunner. Later versions of the SA-7

SA-9 in flight after launch from a BRDM-2 mount. The missile appears similar to the AA-8 Aphid air-to-air missile.



and the SA-9 are thought to have a larger angle of fire; they can be up to 30° off the aircraft's tail and still find their target, although the SA-9 is larger and heavier and has a different control configuration. Sometimes the sunlight glinting off a helicopter's canopy may create enough of an infra-red heat signature for a SAM to home in on.

Because these missiles can only fire at aircraft heading away from them, they must overtake their targets. Thus only aircraft moving at less than 500kt are vulnerable to the early model of the SA-7, which is most effective against those moving at 250kt or less. The SA-7's lead sulphide seeker head, unlike those of more sophisticated heat-seeking missiles, is uncooled and thus easily saturated, especially as it does not attempt to filter out spurious heat sources. Its primitive seeker head means that if the SA-7 is pointed within less than 20° of the sun, it will home in on that rather than its target. Reportedly, if the missile is fired at less than a 20–30° elevation, the seeker head will pick up geothermal heat and home in on that, which makes it almost impossible to hit low-flying aircraft, especially helicopters flying nap-of-the-earth. This seeker head also makes the SA-7 vulnerable to countermeasures.

The 9M32M is reported to be able to engage targets moving at up to 600kt and manoeuvring at up to 8*g*. It has a limited envelope, especially at higher altitudes: for example, against a target moving away at 350kt and 1km altitude the intercept area would be between 1.7 and 5.1km downrange, decreasing to 2.3–5.4km for 2km altitude, 3.3–5.1km for 3km altitude, and only about 4.7km for 4km altitude.

The SA-9's low-level blind spot climbs to 1km altitude only at its maximum range. The cone blind spot above the launcher reaches 5km altitude 1.3km downrange.

The "Mod 1" version of the SA-7, first seen in the mid-1970s, has a more sophisticated guidance system, including a filter for the seeker head. It also has longer range and a higher maximum altitude: a Hawker Hunter fighter-bomber of the Omani Air Force was hit while flying at 3,500m (11,500ft). Its minimum range is still 45m, as with the earlier version. The "Mod 2" SA-7c has a small passive ESM detector (like Hat Box) mounted under the launcher. It replaces an earlier model, which was mounted on the gunner's helmet and was previously thought to be an IFF system.

The Soviet designation *Strella-blok* is reported to be used for a remotely fired version of the SA-7. Fitted with an acoustic triggering device, it is designed to be positioned under an airport approach path, armed and left.

The small size and lack of sophistication of the SA-7, while making it man-portable, meant that only salvo firing gave worthwhile results. The quad-mounted SA-9 system was an answer to this. Mounted on top of a BRDM-2 scout car, the SA-9 is a relatively large, single-stage missile that appears similar to the AA-8 Aphid air-to-air missile.

SA-7 rounds have a design shelf life of ten years, as do larger Soviet SAMs such as the SA-6. The true figure is likely to be about half of this. The high misfire rates suffered by some SA-7 users including the Afghan Resistance are due in large part to "stale" missiles.

The SA-7 lacks the high degree of "soldier-proofing" and simplicity usually found in Soviet weapons, and it is a relatively complex system to use. The battery, mounted at the front of the launcher, has limited shelf life and operating time, is used only by the SA-7, and can easily be inadvertently left on after a system check by the gunner.

The SA-9 has greater range and a larger warhead, and is more manoeuvrable than the SA-7. It was developed at about the same time as the ZSU-23-4, forming the other half of a gun/missile team for regimental anti-aircraft batteries. The original version of the SA-9, designated 9M31 by the Soviets, had an uncooled seeker head similar to that of the early-production SA-7. Later versions, designated 9M31M, have a more discriminating seeker head that also permits different missiles in a salvo to be set to home on emissions from different points on the infra-red spectrum. DIA estimates that 640 SA-9 launch vehicles were in Soviet Army service in 1984; 850 or more have been exported. By the early to mid-1980s the SA-13 and its associated launch vehicle were replacing the SA-9 one for one in Soviet regimental anti-aircraft batteries.

According to a 1983 DIA estimate, SA-9/13 production in 1983–90 is estimated at 2,800 rounds a year, SA-7/14 at 25,000 rounds. By 1978 over 5,000 SA-14s had been produced. Operators outside the Warsaw Pact included Cuba and Nicaragua.

Combat usage

The SA-7 was used in the 1967 Middle East war, and was deployed into South-east Asia in 1969, being introduced into action in April 1972. Initially its accuracy was very high, a 33% accuracy rate being achieved against US gunship and transport helicopters. The SA-7 also shot down several slow-moving aircraft such as O-2Es, A-1s and C-130s, which were then forced to operate above 1,830m (6,000ft). After this step was taken and the surprise wore off, SA-7 effectiveness was reduced. The low overall accuracy of the SA-7 is thought to have been due to its instability; most of those launched were observed to porpoise and miss.

The SA-7's lack of effectiveness against fast-moving jets but potential lethality against helicopters and slow-moving aircraft was shown in South-east Asia in 1972–73.

About 100 SA-7s were fired at Israeli fighter-bombers during the War of Attrition, resulting in one damaged. In the 1973 Middle East war the Arabs made extensive use of SA-7s; US Department of Defense officials have stated that 5,000 were launched. Other sources estimate 4,356 launched from 1,468 launchers. The results were surely disappointing: two Israeli aircraft were definitely de-

Aircraft (destroyed/damaged)	SA-7s fired
F-4 (1/1)	135
A-7 (0/0)	11
O-1 (7/0)	8
A-1 (9/1)	21
A-37 (4/0)	14
O-2 (3/1)	37
OV-10 (4/1)	76
AH-1 (4/0)	12
UH-1 (9/0)	34

stroyed, four were "possibles," 28 suffered tailplane damage and were out of action for a few hours, and a few suffered engine damage and were grounded for a few days. These poor results were due to the SA-7's inadequate warhead, susceptibility to countermeasures, tail-chase operation and, undoubtedly, the low level of training of the men who used it. The SA-7 was used extensively in the 1981–83 Lebanon fighting. Despite the use of effective countermeasures, SA-7s were responsible for practically all the kills of Israeli Air Force and US Navy jet aircraft.

In 1975 the SA-7 was used widely by the North Vietnamese in their conquest of South Vietnam. According to a CIA operative on the scene, "the effect on the South Vietnamese Air Force's morale was devastating, which in turn lowered the morale of the ground troops and contributed to the rapid collapse of resistance." South Vietnamese strike aircraft were forced to stay above 3,000m (10,000ft), and as the South Vietnamese were trained in the low and slow attacks the US had used before the introduction of the SA-7, they found themselves performing medium-altitude missions for which they were not trained in aircraft that were not designed for such operations. Their effectiveness plummeted. Thus the SA-7 successfully performed the deterrent role that is the key to ground-based air defence. Even a poor air defence can be effective when it minimises the accuracy of air strikes on the advancing columns. The number of aircraft shot down did not matter – they were all eventually captured on the ground.

The SA-7's simplicity makes it very attractive to guerillas and insurgents throughout the world. Palestinians in Lebanon and Jordan, Polisario rebels in Morocco and Mauritania, and groups in Iraq, Angola, Mozambique, Zimbabwe, the Philippines and Oman have used it. Americans who have used captured SA-7s say that one day's training can produce an effective gunner. The SA-7's victims have included a Rhodesian Viscount airliner, an Omani Strikemaster and Portuguese G.91R4s. In the 1970–76 war in Oman, 23 SA-7 firings yielded the destruction of one Strikemaster and one helicopter, both of which were flying above what was then thought to be the weapon's maximum effective altitude. Over 100 SA-7s were sent to Argentinian forces in the Falklands, but only a few were fired, without result, before the surrender. The Provisional IRA is reported to have ex-Libyan SA-7s but has never used them in action.

SA-7s have been extensively used in anti-communist insurgencies in the 1980s: in Nicaragua (where they accounted for a Cuban-manned Hip in 1985), in Angola (where increased numbers were received in 1986, leading to the destruction of numerous Communist aircraft), and in Afghanistan.

In 1978–86 a total of 255 SA-7s were fired at South African Air Force aircraft over Angola and Namibia. Only five aircraft were hit and just one – an Impala Mk 2 light attack aircraft – destroyed. Though helicopters attracted 65% of the missiles fired, none were hit; this was due in part to the low-level flight profiles employed by the South Africans.

Whatever its failings, the SA-7 has rendered the whole class of low-technology, low-performance, low-cost, high-payload counter-insurgency (COIN) aircraft almost obsolete. The SA-7 has given the guerilla an effective plane-killing capability for the first time.

Iraqi SA-9s have been used throughout the Iran-Iraq war, without much success. Syrian, Libyan and PLO SA-9s were used in Lebanon in 1981–82 but suffered heavy losses to Israeli aircraft using terrain-masking and infra-red countermeasures. Angolan and possibly Cuban SA-9s have seen action against the South African Air Force in Angola, again without success. The South Africans captured 16 or more SA-9 launch vehicles but found them ill-suited to the environment, the heat of the vacuum-tube electronics making the interior unbearable in summer.

SA-7 tactical employment

The SA-7 is used as a self-defence weapon by each Soviet motorised rifle company. Each motorised rifle company has a section of three SA-7 launchers. Dispersed among different platoons while travelling, in order to provide continuous coverage, it is concentrated when dismounted. In motorised rifle platoons the gunner stands up in his APC hatch, prepared to engage enemy aircraft. When attacking dismounted, the SA-7 gunners advance 20–30m behind the company skirmish line with 15–20m between launchers. On the defensive an SA-7 is emplaced in each platoon strongpoint. Egyptian SA-7 tactics in the 1973 War were more centralised, employing groups of three gunners who normally fired in a salvo. Both the Soviets and Egyptians use SA-7 launchers mounted on jeeps. An East German quadruple truck mount, introduced in 1979, is used for airfield defence.

Soviet airborne and airmobile forces rely heavily on SA-7s for air defence.

SA-9 tactical employment

A platoon of four quadruple SA-9 launchers complements the four ZSU-23-4s of each regimental anti-aircraft battery. During the advance to contact or the exploitation phase of a battle the SA-9s stay near regimental HQ. When the regiment moves into the attack, SA-9s take up overwatch positions one to three kilometres behind the line of contact, behind the close-support ZSU-23-4s. They will be positioned either in a "linear" or "cluster" formation, similar to the ZSU-23-4s. The SA-9s will normally operate as a group, often 2–3km to the rear of the ZSU-23-4s because of their greater range. Special emphasis is placed on protecting the SA-9 launchers from missile-firing helicopters. When the regiment is on the defensive the SA-9s will be sited around regimental HQ or second-echelon battalions.

Radar network and engagement sequence

The SA-9 can be connected with divisional air-defence radars through radio, and is often connected by radio with the Gun Dish radars of ZSU-23-4s when on the defensive.

The Hat Box ESM system is mounted on at least some late-production SA-9 launch vehicles; usually one vehicle per firing platoon has the system. Hat Box is probably designed to pick up the emissions of aircraft radars. Its four antenna panels are mounted on both sides of the hull front, the turret and the hull rear. It provides the bearing of a contact and indicates whether it is approaching or leaving.

An SA-9 battery captured by the Israelis in Lebanon in 1982 had a ZIL-157 truck mounting a Gun Dish radar. It is uncertain whether the Soviets use this system or whether, more probably, it is a Syrian improvisation.

Some versions of the BTR-60PU-12 command APCs associated with SA-9 platoons have been fitted with data links, allowing them to receive inputs from divisional and other radars.

The SA-7 gunner must identify and acquire his target visually, although his platoon will receive air-defence alerts over the radio. The gunner first loads the SA-7 missile in its disposable fibreglass tube on to the launcher gripstock. He then pulls the trigger to energise the uncooled seeker head, a sealed optical tracker containing a folded reflective optical system sensitive to heat. It also supposedly functions as a space-stabilised gyroscope, which may be the reason for the SA-7's reported lack of stability. When the seeker head is energised and uncaged, ready to seek out a target, a red light on the launcher lights up. The gunner then points the launcher at the target. When the infra-red detector cells in the seeker head detect heat energy reflecting off them, a green light comes on and the gunner will fire. The first stage fires in the launch tube, forcing the second stage out, and then falls away at a safe distance from the gunner. The tail fins and canards then unfold, and the missile coasts until it is a safe distance from the gunner. At this point the second-stage sustainer engine cuts in and accelerates the SA-7 to its maximum speed. The seeker head determines the angle of the heat it is reflecting and its guidance system tries to resolve the difference between the direction the seeker head is pointing and the missile's line of flight by moving the missile's variable-incidence wings. Throughout its flight the missile is spinning anti-clockwise for stability. The SA-7 then follows the target in a lag-pursuit course. If it has not hit its target in 15sec it will self-destruct.

Operators of early-model SA-9s relied on visual target acquisition after being alerted of an approaching threat by radio from the divisional search and warning radars. The crew then "buttoned up" against backblast. The gunner traversed the launch assembly manually, boresighted the missile with a simple optical sight, and selected single-fire or salvo. The last caused the canister door to open and uncaged the seeker head. Audio and light signals would then indicate that the system was ready to fire.

Current SA-9s receive targeting information from Hat Box. While the missile itself is fin-stabilised, the SA-9's lack of a fire-control radar and use of an uncooled seeker head make its engagement sequence similar to that of the SA-7. SA-9s are apparently normally fired in four-round salvos, with each missile set to home on a different infrared frequency, in order to reduce the effectiveness of decoy flares.

Countermeasures

The early SA-7 was very susceptible to countermeasures, and could easily be decoyed on to flares ejected by the target aircraft. Later versions are reported to have a filter in the seeker head to reduce spurious emissions, and can be set to home in on the second hottest heat source acquired, rather than the hottest. To defeat this counter-countermeasure, however, aircraft drop flares in salvos of different heat intensities so that, regardless of how the SA-7's seeker head is set, it will still have a flare to home on to. This can be countered to an extent by salvo firing of missiles set for different intensities, and it is believed that this method is usually used with the SA-9. Soviet heat-seeking SAMs now demand a range of responses, with jammers or flares designed to cover a broad-band threat.

The later versions of the SA-7 have a filter to screen out decoy flares. Soviet helicopters dropping flares have been lost to SA-7bs in Afghanistan.

Flares are not the only countermeasure effective against these missiles. US Army helicopters have had heat suppressors installed around their exhausts, and A-4 Skyhawks of the Israeli Air Force now sport long, heat-hiding tail pipes. These make it more difficult for the SA-7 to acquire a target. Infra-red decoy pods, such as the US ALQ-123 caesium lamp, can also defeat heat-seeking

missiles by letting them lock on to their heat source and then jamming the missile's seeker head. The SA-7 is reportedly easy to outmanoeuvre and, like many heat-seekers, it can be decoyed by a climb into the sun followed by a quick turn away, which causes the missile to aim for the sun. The SA-7 launch signature can be seen as far away as 13km (eight miles), and the missile often leaves a contrail. However, neither was apparent in almost half the South-east Asia cases studied.

SA-8 Gecko surface-to-air missile

Year introduced	1974/1980
Length	3.2m
Diameter	0.21m
Tail span	0.6m
Launch weight	130kg
Mount	self-propelled
Missiles on mount	4 open/6 canister
Guidance	radio command
Control method	canard fins and tail surfaces
Propulsion	dual-thrust solid fuel
Max speed	Mach 3
Warhead weight	16kg
Max range	12km
Max altitude	13/19km
Min range	1.6km
Min altitude	10m
Reload time	7–9min (4 missiles)
Reaction time	9–25sec
Burst radius	5m, lethal against F-4 at low altitude
Rate of fire	two missiles simultaneously
Avoidance radius	11.1km or under 152m altitude
Soviet nicknames	*Romb* ("Square"), *Osa* ("Wasp")

Where two figures are given, the first refers to SA-8s, the second to SA-8b Mod 1, introduced in 1980. Other estimates of SA-8b performance differ substantially: **Weight** 130kg, **Warhead** 19kg, **Min range** 1.5km, **Max range** 10km, **Min altitude** 50m, **Max altitude** 5km.

SA-8 launch vehicle

Type BAZ-5937 or ZIL-167E4 (based on ZIL-167 truck chassis) **Length** 9.1m **Width** 2.9m **Height** 4.1m (scanner retracted) **Maximum speed** 80km/h **Maximum water speed** 10–12km/h **Range** 650km **Engine** Diesel **Crew** 4 **Night vision** TVN-2 system **Water propulsion** twin hydrojets

A quadruple SA-8 launcher and its multi-purpose Land Roll radar mounted on a unique six-wheeled amphibious vehicle form a complete and independent integral SAM system, designated a ZRK (*Zenitniy Raketniy Kompleks*, missile system) by the Soviets. The chassis features full NBC protection, a central tyre pressure regulation system and a rear-mounted engine. It carries four SA-8s. These were exposed on the launch rails in the SA-8 initial production version, first deployed about 1974 and paraded in 1977. The improved SA-8b Mk 1 version appeared in 1980. It featured six launch rails, and the missiles were contained in protective canisters. The SA-8b missile is also believed to have improved ECCM capability. Most SA-8a systems were probably upgraded to SA-8b standard. In 1986 the DIA estimated that 765 SA-8s were in service, enough to equip about 35 divisions, and that another 200 had been exported.

Each firing battery of four launch vehicles also has two reload vehicles carrying 18–24 missiles each. These have the same chassis as the launch vehicle, with a large pannier enclosing a crane and storage volume in place of the launcher. At regimental level, 24 ZIL-131 missile-carrying cargo trucks resupply the firing batteries. Also held at regimental level is a single radar-calibration vehicle using the same chassis as the launch and reload vehicles.

Combat usage

Three Syrian SA-8 batteries at Bar Elias, Lebanon, were knocked out by Israeli air strikes on July 24, 1982. Before this, a single SA-8 launch vehicle, said to have been Soviet-manned, had shot down an Israeli fighter-bomber in Lebanon.

In Lebanon SA-8s proved vulnerable to Israeli "hard-kill" tactics, but it is not known whether ECM was as effective against them, the most capable SAMs the Israelis have faced.

SA-8s were organic to the motorised rifle divisions in Afghanistan before the highly publicised "withdrawal" of three SA-8-equipped regiments in 1986. SA-8s have been used against South African aircraft in Angola, without success. Libyan SA-8s are reported to have been used in action against US air strikes in 1986.

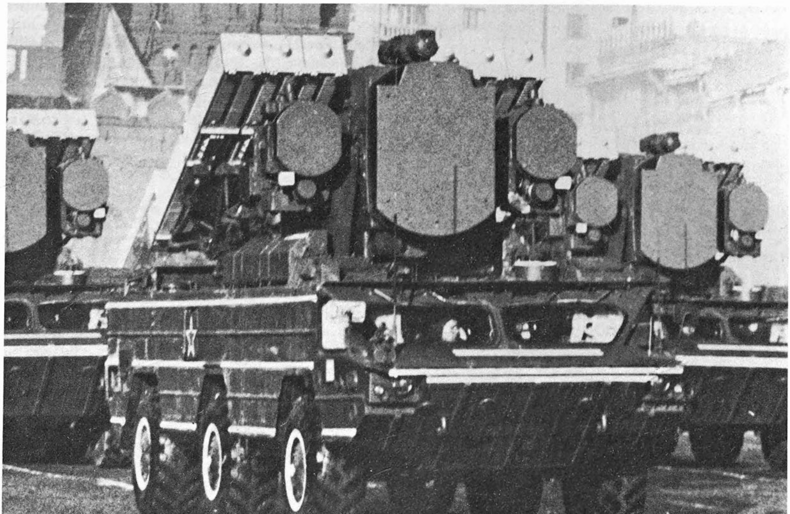
The SA-8 appears to be a highly manoeuvrable missile, and possesses the acceleration needed to engage manoeuvring high-performance fighter-bombers at low altitude. An SA-8 ZRK can engage one target with two missiles.

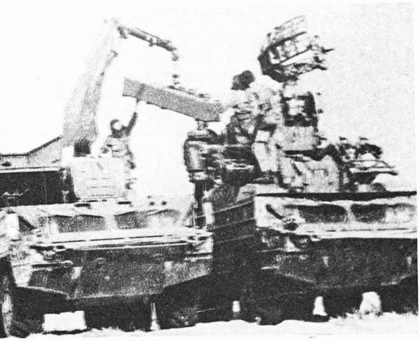
Tactical employment

The SA-8, along with the SA-6, has replaced the S-60 in many Soviet divisional anti-aircraft regiments. The SA-8 and SA-6/11 never serve alongside one another in the same division. This may reflect different divisional missions or a desire to benefit from the complementary effect of the two systems. While the SA-8 is shorter-ranged than the

SA-8 launch vehicles on parade in Moscow, November 1977. The Land Roll's search radar and TV tracker are folded back behind the turret, but the tracking radar and the two command-link horns are visible on the turret front.

Standard six-launcher SA-8b Gecko vehicle on parade in Moscow. *(US Army)*





An SA-8 reload vehicle uses its on-board crane to position a missile canister on the racks of a launch vehicle, which has its Land Roll radar extended. *(US Army)*

SA-6/11, a battery of SA-8s can engage more targets and put more missiles in the air.

The boat-like hull of the SA-8 launch vehicle shows that it is designed to support river crossings and can swim rivers with advancing BMPs, rather than having to wait to be ferried across. The characteristics of missile, radar and launcher indicate that the SA-8 system is intended to fill the gap between point and area-defence weapons in the fluid situations which the Soviets expect in modern combat.

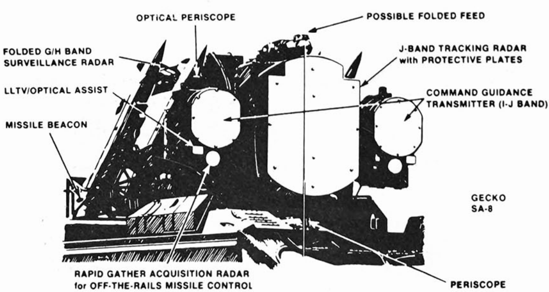
Radar network and engagement sequence

Early warning and long-range target acquisition is passed from division-level radars. The SA-8's Land Roll radar comprises a single turret mount including a mast-mounted search radar which operates in the 4–8GHz band with a 30km range. In front of the turret is the tracking radar with a 20–25km range, operating in the 13–15GHz band. On the turret sides are the twin antennae of the I-band command-link horns which transmit instructions to the missile in flight. Each missile is guided on a different frequency, allowing two to be directed at a single target and making ECM more difficult. An improved, low-light version of the TV tracker used with the SA-3 is mounted on top of the turret. The Land Roll radar is conical-scan rather than continuous-wave, making it more efficient (and cheaper) and enhancing its low-altitude performance.

The SA-8 is the heir of the S-60, carrying out the same missions. When a division is moving, SA-8 batteries will be interspersed with the columns, either moving with them or in overwatch positions. Highest in priority for protection are the first-echelon regiments (up to two batteries allocated), headquarters, and the artillery and SS-21 battalion (one battery each). Unlike the S-60, however, an SA-8 unit can cover all of a divisional area.

When the Land Roll's surveillance radar acquires the target and IFF interrogation shows it to be hostile, the vehicle commander selects the target to be attacked on a panoramic display of radar information and automatically or manually designates the target to the weapons controller or the tracking radar. The whole turret assembly then tracks the target and, when the fire-control system has data, two missiles are usually launched. Command guidance is then similar to that used by the SA-2 and SA-3. The SA-8 has no terminal homing.

It has been reported that the ECCM capabilities of Land Roll include frequency-hopping and monopulse.



The elements of the Land Roll radar. *(EW Communications)*

This might make it resistant to ordinary noise and deception jamming.

The SA-8's low-altitude blind spot is limited, exceeding 1,000m only at the outer limit of its range.

The SA-8 emits a large, tell-tale smoke cloud when fired. The unique launch vehicle also alerts observers to the presence of SA-8s.

The SA-8/Land Roll system is believed to be similar to the SA-N-4/Pop Group naval SAM system and may have been developed from it.

SA-10 Grumble surface-to-air missile

Year introduced	1978
Length	7m
Diameter	0.45m
Wingspan	0.8m
Launch weight	1,600kg
Mount	static (SA-10a), trailer, or truck-mounted (SA-10b)
Guidance	command (track via missile)
Terminal homing	radar
Propulsion	integral 2-stage
Max speed	Mach 6
Max range	100km
Max altitude	30km
Min altitude	0.3km
Low-level dead zone	5–10km

(All figures approximate)

The SA-10 presages a new generation of Soviet SAMs. Very fast, long-ranged, capable of extremely high acceleration (100g) and manoeuvrable, the SA-10 is a threat to cruise missiles and low-flying strike aircraft such as the F-111, Tornado and B-52. Reported to be a product of the Grushin design bureau, it had a long and difficult development. At one point all SA-10s were recalled from field units for modification, and it was not until 1985–87 that the system appeared to be working properly.

Guidance mode is uncertain, although active radar appears most likely. This would yield a "fire-and-forget" capability. The system has multiple target engagement capability and may use vertical launch.

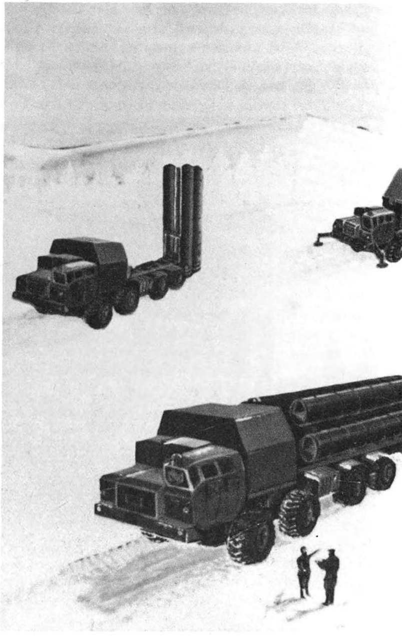
SA-10 could well be effective against cruise missiles and tactical ballistic missiles such as the US Lance. Estimates of performance vary widely (range and altitude may be half or two-thirds of those given above). The system is reported to have been developed from, or to be a land-based version of, the SA-N-6 SAM used on the *Kirov*-class battlecruisers. SA-N-6 is reported to incorporate a "track via missile" system able to receive course corrections from the Top Dome radar. In 1983 the DIA estimated SA-10 production at 900 rounds annually, rising to 1,600 a year in 1985–90.

SA-10 uses continuous-wave pulse-Doppler radar guidance.

No conclusive date for the start of SA-10 deployment has been established. While the system is reported to have been first deployed along the Baltic coast in 1978, these examples were pre-production units. Most likely date is 1980. This would give credence to reports that by 1985 some 60 four-launcher static SA-10 positions had been established in the Soviet Union. The SA-10b mobile front-level version had entered service by 1985.

The battery deployment is probably similar to that of the SA-3, and the new system appears to be performing the same roles as the earlier type: defending high-value targets in the Soviet Union and Eastern Europe and complementing the older, higher-altitude SA-5.

The mobile version of the SA-10b, shown in travelling position (foreground) and launch position (background), along with its phased-array fire-control radar vehicle (right rear). *(US Department of Defence)*



The mobile version of SA-10 was developed in the late 1970s and early 1980s and deployment had probably started by 1985–6. Before that there may have been trailer-mounted transportable versions in service alongside the static mounts. The truck-mounted versions probably feature four cylindrical launch tubes on a version of the MAZ-7910 truck. The canisters can be flipped up to the vertical launch position. The battery radar is also carried on an MAZ-7910. A battery is believed to consist of three launch vehicles, one radar vehicle, two or three reload vehicles using the same MAZ-7910 chassis, and command and support vehicles.

Radar network and engagement sequence

Little is known of the SA-10's radar network, though it is believed that the radars are more advanced than those of previous Soviet SAM systems. Target detection is carried out by a regiment-level Big Bird radar, designation by a battalion or battery Clam Shell, and guidance by the Flap Lid of individual sites or launch vehicles. All these radars are continuous-wave and have low-altitude capability. Clam Shell is 3-D, removing the need for a separate heightfinder. A mobile tower-mounted radar, possibly Big Bird, has been associated with SA-10.

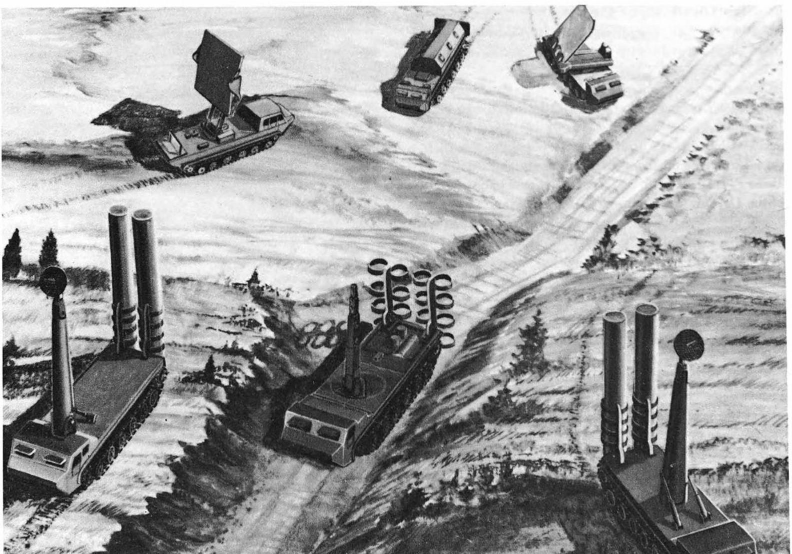
If the SA-10 uses active homing, it may have a fire-and-forget capability; in that case the Flap Lid would probably not have an illumination function.

Tactical employment

The first fixed SA-10 site probably became operational in 1980. A total of 60 sites had been deployed by 1985, with 30 more being built. Half of the sites are around Moscow, the remainder being used for point defence of key command and control, military and industrial assets. SA-10 has been replacing the ageing SA-1 systems around Moscow. It is also said to be replacing SA-2s in the Soviet Union and, probably, the forward areas, and SA-3s in the airfield defence mission.

By 1986 a total of 80 static SA-10 sites were operational – half of them in the Moscow region, with others identified on the Kola Peninsula – and 20 more were under construction. In 1985 the CIA estimated that SA-10s constituted about 15% of the SAMs defending the Soviet homeland, and expected this to rise to 60% (20% in the Groups of Forces) by the mid-1990s, by which time East Germany would probably also have received the system. The SA-10 apparently has defence against strategic cruise missiles – and tactical cruise missiles in the forward areas – as its primary mission. It may also have a secondary

Artist's impression of the various vehicles of the SA-12 family, all based on the MT-T. In the foreground, SA-12a and SA-12b launch vehicles flank their reload carrier. In the background, right to left, are the fire-control radar, command vehicle, and warning and acquisition radar. *(US Department of Defence)*

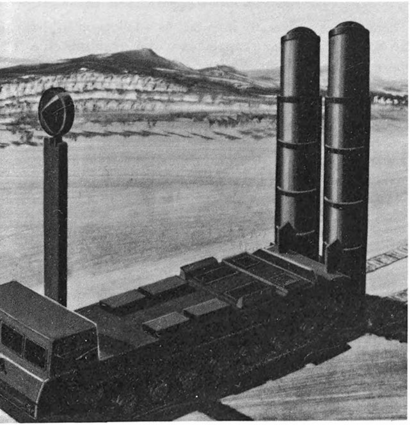


anti-tactical ballistic missile capability, making it complementary to the SA-12.

SA-12a Gladiator and SA-12b Giant surface-to-air missiles

Length	7.5m
Diameter	0.5m
Mount	twin self-propelled
Guidance	semi-active radar/command
Control method	control surfaces (Gladiator) thrust (Giant)
Propulsion	integral solid
Max range	100km/70km
Max altitude	30km
Min altitude	30–90m
Warhead	HE

The SA-12 could become the Soviet Army's most significant high-altitude SAM in the next decades, replacing the SA-2, SA-4 and SA-5. Unlike these systems, however, the SA-12 is effective against tactical aircraft and low-altitude targets. The SA-12, in at least some of its versions, also possesses a significant new capability, being able to shoot down tactical ballistic missiles like Pershing and Lance. Further, SA-12 could also be able to intercept



Artist's impression of the SA-X-12 Giant ATBM launch vehicle in firing position, with launch tubes vertical and on-board radar deployed. The launch vehicle itself seems to be based on the MT-T series. *(US Department of Defence)*

strategic warheads as well. It has been reported that SA-12s have been tested against Scud and SS-4 IRBMs following the revival of Soviet interest in ABMs in the early 1980s; SA-5s were also tested in this role. US authorities have said that the SA-12 "may have the potential to engage some types of strategic ballistic missiles and cruise missiles". However, according to US press reports, the initial tests of SA-12b Giants against SS-1c Scud tactical ballistic missiles were not encouraging, yielding only a 5% kill rate.

Systems like the SA-12 show why the Soviets have abandoned the distinction between national and Army air defence as artificial. The SA-12, while having all the characteristics of an "Army" air defence system (being a mobile SA-4 replacement), is reported also to have been deployed to protect SS-18 and SS-25 ICBMs against SLBMs. It can also be integrated with the phased-array radar at Krasnoyarsk. Deployment in this strategic defence mission was under way in 1986–87.

Following a development that began in the 1970s, SA-12 production is believed to have started in 1984–85 and deployment in 1986. This development-to-deployment time is longer than for many Soviet systems, and may reflect the increased sophistication of the system, the need to integrate new technology, and the production bottlenecks, especially in the area of radar, known to exist in Soviet weapons programmes in the mid-1980s.

The SA-12 system is believed to include two different missiles: the standard SA-12a Gladiator, used against aircraft and cruise missiles, and the SA-12b Giant ATBM. Because the missiles have not yet been seen outside their launch tubes, it is not known if there are any physical differences. Nevertheless, they are believed to be substantially different missiles, with diagrams of Giant suggesting that it uses vectored thrust rather than control surfaces for guidance.

Both missiles are launched vertically. This may be linked to their use of a "pop-up" flight pattern, climbing initially before looking down on low-level penetrators. The US Standard 2 is reported to operate in a similar way.

The SA-12 vehicles all appear to be variations on a single design, itself based on the MT-T. The launch vehicles for both Giant and Gladiator have two launch tubes. Each also has a telescopic mast for the guidance radar. The reload vehicle carries four missile tubes. In addition, there are engagement radar, search radar and command vehicles. All are believed to have on-board secure data links, an advance on traditional Soviet practice.

a degree of autonomous engagement capability. The system's phased-array radar has a range of up to 250km and can handle multiple targets. The SA-12 system as a whole is believed to embody a great deal of "acquired" Western technology, especially in its computers, phased-array radar, and fire-control software.

Combat usage and weapons effectiveness

The SA-12 has never seen combat. Its effectiveness depends on the successful integration of a number of complex sub-systems, so the performance of earlier Soviet SAMs may not be an adequate indication.

Tactical employment

The SA-12 will significantly improve Soviet Army SAM coverage, the army and front-level area-defence units having relied until now on the elderly SA-2 and SA-4. SA-12 represents the advanced area-defence, high-altitude-capable SAM needed to complement the recent improvements in point-defence systems.

The ATBM capability of SA-12 is perhaps its most significant attribute. The Soviets obviously do not intend to protect themselves against enemy aircraft while ignoring the increasing threat from accurate surface-to-surface and air-to-surface missiles with both conventional and nuclear warheads.

An SA-12 battery will probably consist of three launch vehicles (one configured for ATBMs), one reload vehicle, and a radar and command vehicle. A battalion will have three batteries, plus an acquisition and early-warning radar and two command vehicles. A brigade will have three battalions, two acquisition and early-warning radar vehicles and three command vehicles. It has been reported that SA-12 "batteries" tasked with strategic defence have 48 launchers.

SA-12 battery deployment will probably be similar to that of the SA-4. The three launchers will be in line, "V" or wedge, with 100–150m spacing between launchers and also between each launcher and the radar vehicle. The command vehicle will be about 50m away from the radar, linked by a secure landline. ZSU-23-4s or ZU-23s will be in overwatch positions, 200m to the rear.

Radar network and engagement sequence

Long-range target-acquisition radars are believed to be held at battalion and brigade level. These would pass information to the engagement radars at battery level, which would in turn hand over the targets, when in missile range, to the on-vehicle radars of the launch vehicles. These would then track and fire.

Countermeasures

Because of its advanced technology, the SA-12 is probably less susceptible to countermeasures than other Soviet SAMs.

SA-13 Gopher surface-to-air missile

Year introduced	1976–78
Length	2.2m
Diameter	0.12m
Span	0.4m
Launch weight	55kg
Max speed	Mach 2
Max range	8km
Max slant range	8km
Min range	0.5km
Max altitude	9.6km
Min altitude	9m
Effective altitude	3.2km
Warhead	6kg HE
Mount	MT-LB
Guidance	infra-red homing
Rounds on launcher	4 (combat), 2 (training)
Reload rounds	4–8
Radar type	range only
Launch vehicle	
combat weight	13 tonnes
length	6.6m
width	2.9m
height	3.8m (firing), 2.3m (travelling)

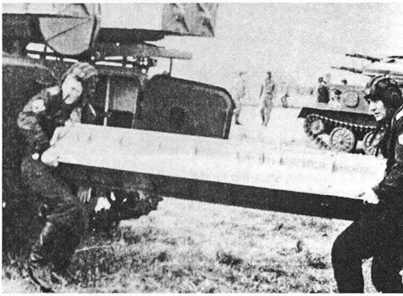
(All other launch vehicle data as MT-LB)

The SA-13 is apparently intended as a follow-on to the SA-9, providing a more capable heat-seeking missile on a more mobile platform. The use of the MT-LB – minus machine-gun turret – as launch vehicle yielded superior cross-country mobility and more room for reloads (reloading is still done manually). It is also fully amphibious and has an NBC protection system. A pintle-mounted PKT 7.62mm machine gun in front of the forward hatch is used for local protection. The launch vehicle can mount both SA-13 canisters and the smaller SA-9 units. As with SA-9, only two canisters are fitted for training, and the whole launcher assembly is usually lowered when travelling. A modified SA-13 launch vehicle, first seen in 1987, has extra missile stowage canisters, each probably containing two rounds, mounted externally on its sides.

At least two versions of the SA-13 launch vehicle had been identified by the mid-1980s, the Mod 2 differing from the Mod 1 in having the Hat Box ESM antenna array, as fitted to some SA-9 vehicles. The SA-13 itself is larger than the SA-9, offering longer range and a bigger warhead. Nicknamed *Strela* ("Arrow") *10* by the Soviets, it has a cooled seeker head (unlike the SA-7 and at least early-model SA-9s) which operates in two frequency bands. This makes it less susceptible to countermeasures and "background" radiation from the sun or ground.

Above SA-13 launch vehicles with two instead of the standard four launch canisters and no Hat Box—a typical training arrangement—but with external stowage that may contain additional missiles.

Right SA-13 crew carry a missile canister removed from inside their MT-LB launch vehicle. Canisters can also be stowed externally on the hull sides. At least some Soviet regiments have six SA-13 launch vehicles each.



The range-only radar (which lacks a NATO codename) gives the SA-13 a limited adverse-weather capability.

Combat usage

Libyan forces used SA-13s in Chad in 1987–87 and several launch vehicles were captured. They appear to have destroyed no French or Chadian aircraft. MPLA forces used SA-13s (designated 9M37M) without success in Angola in 1987.

Tactical employment

The SA-13 started to replace the SA-9 in GSFG in 1980, some years after it had entered service in USSR-based units. It has since been reported in other Groups of Forces in Eastern Europe. It is apparently employed in the same way as the SA-9. SA-13s have been deployed in Afghanistan, where they have been used for airfield defence and to cover artillery firebases.

Radar network and engagement sequence

The SA-13 launch vehicles are connected by radio to divisional air defence radars; they can also use target information developed by ZSU-23-4s or the Dog Ear early-warning radar vehicle. Once a threat has been identified, Hat Box can provide bearing information, allowing the radar to be pointed down the threat axis. With the radar locked on to the target, the SA-13 can fire without visual sighting. It would probably be fired in salvos, in the same way as the SA-9.

Countermeasures

The SA-13 is likely to be fairly vulnerable to the range of countermeasures used against IR-homing missiles. But its improved seeker-head technology would probably make it less susceptible than the SA-9.

SA-14 Gremlin and SA-16 surface-to-air missiles

Tube length 1.4m **Missile diameter** 0.07m **Missile weight** 10.5kg **System weight** 18.7kg **Guidance** infra-red homing (SA-14), laser beam-riding (SA-16) **Range** 6–7km **Maximum altitude** 5km+ **Warhead** 2kg HE

SA-14 Gremlin, showing modified missile nose and gripstock. *(Jane's Defence Weekly)*

The SA-14 is the replacement for the SA-7. The SA-14/16's Soviet nickname is *Igla* (Needle). It was developed in the mid to late 1970s and deployment started in about 1978. Its improved infra-red guidance probably includes a cooled seeker head and, like many recent Soviet SAMs, it may incorporate Western technology. The basic gripstock configuration, with an additional pistol grip, and one-man operation of the SA-7 are retained.

While the SA-14 has the same muzzle configuration as the SA-7, one of the principal distinguishing features of the SA-14 is the protrusion of the missile cone from the front of the launcher; this may be related to the cooling of the seeker head. The sights have been moved to either side of the handle. The protective shield around the tube muzzle, another change from the SA-7, probably protects the coolant bottle during launch. The SA-16 lacks the battery mounted prominently at the front of the SA-7 gripstock. It is reported to be able to engage targets manoeuvring at up to 8g. Export examples probably lack many of the features of Soviet Army versions. Like the SA-7, the SA-14 has no tripod or other mount.

The SA-16 (designation uncertain) is a later development, and deployment probably did not start until 1986–87. It differs from the SA-7 probably in using laser beam-riding guidance instead of infra-red. In this respect it resembles the US-designed Sabre, regarded by the US Army as an alternative to the infra-red Stinger.

Combat usage and tactical employment

SA-14 has been exported to Cuba, Finland, Nicaragua, Angola and Syria, among others. The SA-14 (whose Soviet designation may be *Strella*-3, *Strella*-1 being the SA-9, *Strella*-2 the SA-7 and *Strella*-10 the SA-13) may have been used in action in Nicaragua in June 1987, downing a Contra helicopter. Angolan SA-14s have been captured by Unita.

It is thought that SA-14 will replace SA-7 one for one and be used in basically the same way. The Soviets will probably try to use SA-14s alongside SA-7s for a number of years, forcing an adversary to use multiple countermeasures.

It is not known how the SA-16 will be deployed.

Engagement sequence and countermeasures

SA-14 engagement sequence is probably basically similar to that of the SA-7.

This missile is probably an SA-14. The attachment under the muzzle could indicate infra-red homing with a cooled seeker head.

The SA-16 gunner will probably "lase" the target. Maximum range is likely to be about 4km for a helicopter nose-on, 8km for side-on. When he receives an indication that the beam is on target, the missile may be fired. The gunner will probably have to keep the target in the cross-hairs until the missile hits; this may take as long as 20sec.

Lasers have so far not been subject to active jamming, and neither radar jammers nor flares are likely to have much effect. It is however possible to fit an aircraft with a system sensitive to laser illumination and capable of warning the pilot to take evasive action. If it turns out that the SA-16, unlike the SA-7, is not a fire-and-forget weapon, then countermeasures will include violent manoeuvres to throw off the gunner's aim, and suppressive fire at the launch position.

SA-X-15 surface-to-air missile

Max range	15–16km
Max altitude	18km
Min altitude	18m
Missile length	3.5m
Missile diameter	0.6m

The SA-X-15 is a follow-on to the SA-8. Little is known of it except that it may be similar to the naval SA-N-9. It probably has improved command guidance or active homing, is likely to embody Western technology and may use the same vehicle as the SA-8.

SA-X-17 surface-to-air missile

Little is known of this system, said to be under development in 1986–87. It is believed to be a follow-on to the SA-11 and may use the same launch vehicle. It is possible that the SA-X-17 has an ABM capability and a fixed radar, in which case it could be an SA-5 follow-on.

SA-1 Guild

Soviet designation R-113 **Introduced** 1954 **Configuration** Single-stage, liquid-fuel **Launcher** Single, vertical **Length** 12m **Diameter** 0.71m **Weight** 3.5 tonnes **Guidance** Command (similar to SA-2) **Warhead** 250kg HE **Maximum speed** Mach 2.5 **Maximum altitude** 20km **Maximum range** 32–40km **Reloads per launcher** 2 **Fire-control radar** Yo-Yo (E-band, range 150km) **Early-warning radar** Tall King (A-band, range 550km) **Acquisition radar** Gage (E-band, range 300km) **Heightfinding radar** Patty Cake (D/E-band, range 200km)

Despite the system's age and obsolescence, 2,200 SA-1 launchers out of a total of 3,200, all deployed around Moscow, were still operational as late as 1986, according to DIA estimates. Designed for use against massed formations of 1940s bombers, the SA-1 introduced many of the features refined in the SA-2. It is being replaced by the SA-10.

Foreign use of Soviet SAMs

All figures are for launchers unless otherwise indicated.
Afghanistan: two commands of SA-2/3.
Algeria: SA-2 (24), SA-3 (20), SA-6 (10), SA-8 (10), SA-9 (20).
Angola: SA-3 (40), SA-6 (6), SA-8 (30), SA-9 (30), SA-7.
Bulgaria: SA-2/3 at about 30 sites. Army has SA-6 (30), SA-7, SA-9.
Cuba: 60 SA-2, 140 SA-3 in 28 battalions, 12 SA-6, 50 SA-9, SA-7, SA-14.
Czechoslovakia: 40 SA-2/3 sites, 25 SA-4, 180 SA-6, 150 SA-9, 100 SA-13, SA-7, SA-14.
East Germany: SA-2/3/5 (about 24 sites, half SA-3), 25 SA-4, 120 SA-6, 40 SA-8, 95 SA-9, SA-7/14.
Egypt: Many, though not all, Soviet systems serviceable. 60 SA-2 sites (400 launchers), 50 SA-3 sites (240), SA-6 (75), SA-7.
Ethiopia: SA-2/3/7.
Finland: SA-3, SA-7.
Hungary: 20 SA-2/3 sites, 80 SA-6, 8+ SA-8, 50 SA-9, SA-7/14.
India: 180 SA-2/3, 30 SA-6, 20 SA-8, 50 SA-9, SA-7.
Iraq: SA-2/3/6/7/8/9. 25 SA-6 launchers supplied.
Jordan: 20 SA-8.
Kuwait: SA-6/7/8.
Libya: SA-2/3/5(three sites)/6/8/9/13/7.
Mongolia: SA-2 battery, SA-7s.
Mozambique: SA-3 (10), SA-7.
Nicaragua: SA-7, SA-14, SA-3 anticipated.
North Korea: SA-2 (45 sites), 30 SA-3, SA-7.
Peru: SA-3, SA-7.
Poland: SA-2/3 (50 sites), SA-6 (280), SA-9 (225), SA-7/14.
Romania: SA-2 (20 sites), SA-6, SA-9, SA-7.
Somalia: Had SA-2/3/7, few if any now operational.
Sudan: 20 SA-2, SA-7 (serviceability unknown).
Syria: SA-2/3 (28 batteries), SA-6 (28 batteries), SA-5 (48 launchers at 3–4 sites), SA-8, SA-9, SA-11, SA-7, SA-14.
Vietnam: SA-2/3 (20 regiments), SA-6/7/9.
Yugoslavia: SA-2 (8 battalions), SA-3 (6 battalions), SA-6/7/9.
Argentina, Botswana, Cyprus, Ghana, Guinea, Guyana, Iran, Laos, Mauritania, Seychelles, Sierra Leone, Uganda, Zimbabwe: SA-7.

US use of Soviet air-defence weapons

The US armed forces are among the lesser known but most significant users of Soviet air-defence weaponry. While the US inventory of these weapons is small, they are studied and used in the development of weapons and tactics to defeat them. The protection of the A-10 ground-attack aircraft was tested by firing a Soviet 23mm cannon at a full-size mock-up. The shells bounced off the titanium armour.

It is an open secret that most of these weapons have been acquired from Israel, although many of the older systems were captured in South-east Asia. Indonesia has quietly disposed of some of its Soviet-built arsenal, and US military personnel in Iran examined the ZSU-23-4s in use there.

Among the types of Soviet air-defence weapons possessed by the USA are the ZPU-4, the ZU-23 (captured in South-east Asia and treated mainly as trophies or museum pieces), ZSU-57-2 (one was seen as Nellis AFB in 1978), the S-60 (believed to be from South-east Asia, possibly from Israel), and a number of ZSU-23-4s, also probably from Israel. It is probable that the USA has other Soviet air-defence weapons as well.

The USA obtained SA-2s from Israel as early as the late 1960s, and this may have contributed to the increasing effectiveness of countermeasures against them in the later stages of the Vietnam War. These may have been supplemented by later acquisitions. At least one working SA-3 launcher is reported at Nellis AFB, where it has been used in the testing of the cruise missile. SA-7s are also used for training.

Less is known about Soviet air-defence radars in US hands. The most spectacular acquisition was a P-12 Spoon Rest early-warning radar, heli-lifted from the Egyptian island of Ras Gahrib after being captured by Israeli commandos on December 26, 1969. After thorough examination by the Israelis it went to the USA. The US SA-2 and SA-3 sites doubtless have their Fan Song and Low Blow radars.

Soviet Army air-defence radars

Early-warning and target-acquisition radars

P-15 Flat Face

Power: 400–500kW; frequency: C-band; maximum range: 250km; emplacement time: 10min; vertical beamwidth: 5°; horizontal beamwidth: 2°; accuracy: 90–100m in range, 0.5° in angle; antennae: two elliptical parabolic reflectors. Van-mounted; four allocated to each early-warning battalion of each air-defence brigade.

P-15M Squat Eye

Performance: as **Flat Face**, but with improved low-altitude capability. Single antenna mounted on 30m mast.

P-12 Spoon Rest

Power: 350kW; frequency: A-band, 147–167MHz; maximum range: 270km; vertical beamwidth: 2.5°; horizontal beamwidth: 1°. Mounted in two vans; used by the early-warning battalions of air-defence brigades.

Long Track

Frequency: E-band, 2,600MHz; max range: 150km+, 30km+ at altitude. AT-T-mounted; one used by each SA-4, SA-6 or SA-8 brigade/regiment; one per SA-4 battalion.

Thin Skin A and B

Frequency: H-band. Truck or trailer-mounted. Height-finding radar with low-altitude capabilities, used in conjunction with Long Track. One used by each SA-4 or SA-6 brigade/regiment headquarters.

PRV-11 Side Net

Frequency: 2,560–2,710MHz; maximum range: 176km. Height-finding radar used with Spoon Rest and Flat Face. Antenna: elliptical paraboloid. Antenna height: 10m. Scan rate: 6rpm. Used with: SA-2/3/5. Mounted on the side of a van.

Back Trap

Frequency: 2.2GHz. Antenna height: 16m. Scan rate: 6rpm. Used with: SA-5, early-warning units.

P-14 Tall King

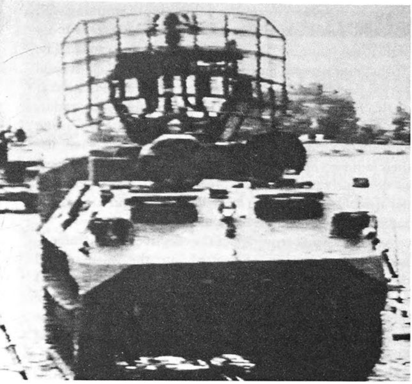
Frequency: 0.172GHz. Antenna height: 13m. Scan rate: 6rpm. Used with: SA-5. Being replaced by Big Back (L-band, 3-D).

Odd Pair

Height-finding radar. Large and small Orange Peel "sails" mounted side-by-side on a van. Frequency: 2.6GHz. Antenna height: 10m. Scan rate: 6rpm. Used with: SA-5.

Dog Ear

The 50km-range Dog Ear early-warning and target-acquisition radar is mounted on an ACRV-2 (MT-LBU) chassis. A target-acquisition section with one Dog Ear and its five-man crew is organic to each regimental air defence battery. The system supplies target alerting and information to the SA-9/13 and ZSU-23-4/30-2 fire units.



Dog Ear radar vehicle followed by the ZSU-23-4s of the regimental air defence battery to which it belongs. *(Jane's Defence Weekly)*

AAA fire-control radars

Gun Dish
Power: 100–135kW; frequency: J-band; maximum range: 20km. Mounted on each ZSU-23-4.

SON-9A Fire Can
Power: 300kW; frequency: E-band, 2,700–2,900MHz; maximum range: 90km for search, 80km for target acquisition, 35km for tracking; accuracy: 12–15m in range, 2m in elevation; pulsewidth: 0.3–0.8 microsec; PRF: 1,840–1,900pps. Uses parabolic dish antenna. Trailer-mounted; one is organic to each S-60 battery. Being replaced by Flap Wheel.

Flap Wheel
Frequency: I/J-band, 9,130–9,850MHz. Truck-mounted, it also acts as a predictor. Organic to S-60 batteries, also used by the 130mm AA gun.

SAM fire-control and command-guidance radars

Big Bird
Frequency: 3.3GHz. Scan rate: 5rpm. Antenna height: 4m. Used with SA-10.

Clam Shell
I-band. Used with SA-10.

Square Pair
Range: 160km. Frequency: H-band (6.8GHz). Antenna height: 6m. Polarisation: circular. Used with: SA-5 (one per battery).

Fan Song A/B
Power: 600kW; frequency: E/F-band, 2,965–2,990 MHz for the A model, 3,025–3,050MHz for the B model; maximum range: 60–120km; vertical beamwidth: approx 10°; horizontal beamwidth: approx 2°. Two orthogonal antennae. Mounted on a trailer or in a bunker. Has a track-while-scan function and uses two flapping beams, one from each antenna. One used per SA-2 battery.

Fan Song D/F
Power: 1.5MW; frequency: C-band, 4,910–4,990, 5,010–5,090MHz; vertical beamwidth: approx 7.5°; horizontal beamwidth: approx 1.5°; max range: 70–145km. Has lobe-on-receive-only function to minimise vulnerability to sidelobe jamming. F model has a visual observer's position on top of the mount but is otherwise the same as earlier versions. E version has track-while-scan function.

Low Blow
Power: 250kW; frequency: I-band, 9,000–9,460MHz; vertical beamwidth: 12°; horizontal beamwidth: 1.5°; maximum range: 85km, depending upon conditions, target size and altitude; pulse repetition rate: 1,750–3,500pps; pulsewidth: 0.25–0.5 microsec. Effective in surface clutter. Allocated one per SA-3 battery. Has a pair of antennae mounted orthogonally on a trailer, with control in van or bunker.

Pat Hand
Frequency: H-band, 6–8GHz. Mounted on SA-4 launch vehicle chassis. One per SA-4 battery.

Straight Flush
Frequency: uses D-band for illumination, and G, H and I/J bands for acquisition and missile guidance; maximum range: 60–90km, depending on conditions, target altitude and size; max altitude: 10km. Mounted on chassis of SA-6 launch vehicle; one allocated per SA-6 battery.

Land Roll
Frequency: G/H, I/J-bands (G/H-band used for surveillance, I/J for tracking), 14,200–14,800MHz; maximum range: 30km surveillance, 20–25km target tracking; vertical beamwidth: 1°; horizontal beamwidth: 3°. One mounted on each SA-8 launch vehicle.

Flap Lid
Frequency: 10.0GHz. Used with SA-10.

There is no detailed information available on the radars currently in use with the SA-6b, SA-10, SA-13, SA-X-15 and SA-X-17.

Soviet Army air-defence ESM and radar jamming

Tube Arm
One per SA-11 battery, acquisition and tracking, separate radar vehicle.

Fire Dome
On each SA-11 launch vehicle, used for missile guidance.

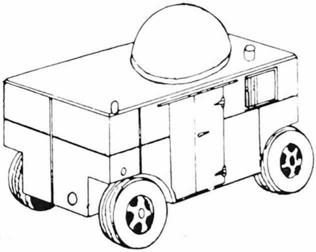
Bill Board
SA-12 acquisition radar, illustrated in left background, page 360.

Grill Pan
SA-12 fire-control and guidance radar, illustrated in right background, page 360.

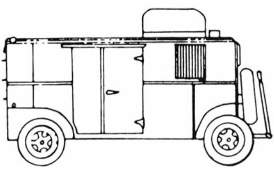
Ground-based radar jammers and ESM receivers are the least known Soviet air-defence weapons. They include the Brick-series jammers and ESM receivers: the trailer-mounted Mound Brick, Box Brick and Tub Brick, and the truck-mounted Cheese Brick, High Brick and Long Brick. Tub Brick is used against radar bombing systems.

While Soviet jammers and ESM receivers are also used against ground radars and radios, in the air-defence role they supplement AAA and SAMs. The Soviets can jam the sophisticated bombing and navigation radar system of the A-7 Corsair II strike aircraft. Parts of the F-111's bombing and navigation system are also vulnerable to jamming, and the Soviets undoubtedly intend to force the F-111s to fly higher by jamming their terrain-following radar. The North Vietnamese, lacking jammers, picked off several F-111s penetrating down valleys by firing chaff in mortar shells. This jammed the F-111s' terrain-following radar, forcing the aircraft into a 3g pull-up and into a waiting anti-aircraft ambush. It is likely that the Soviets will use their jammers in a similar way. Presumably other Western tactical aircraft are also vulnerable to these jammers. Air-defence jammers are organic to front and army-level radio-electronic combat battalions.

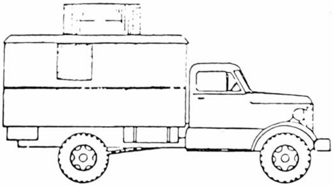
As well as being required for the effective use of jammers, ESM radar detectors are netted into the warning and target-acquisition system. The original Brick-series ESM systems of the late 1940s were intended to detect the navigation radars of high-altitude bombers. Since then the Soviets have developed systems capable of detecting and identifying a broad range of airborne radars.



Mound Brick. *(EW Communications)*



Tub Brick. *(EW Communications)*



Cheese Brick. *(EW Communications)*

Chapter Fourteen
Reconnaissance

"Under modern conditions the importance of reconnaissance continues to increase. At the present time each unit commander is obliged always to have at his disposal complete and reliable data on the enemy, with such data being obtained not only from higher headquarters, but through the use of his own resources."

COL M. TRUSHCHENKO

The Soviet concept of reconnaissance and intelligence – *razvedka* – is broad, including all information-gathering activities. Military intelligence work, espionage, naval reconnaissance, strategic and tactical air reconnaissance, electronic reconnaissance and intelligence, army long-range reconnaissance patrols, troop reconnaissance and combat reconnaissance patrols are complementary and interlocking ways of providing the information needed by Soviet commanders at all levels, especially in a mobile battle. Reconnaissance – of the enemy, the terrain and other conditions – is required for successful combat operations.

The concept of deep operations, especially if carried out without nuclear weapons, gives reconnaissance a new importance. In the days of Soviet nuclear primacy, an offensive could rely on an intense opening strike against pre-planned targets, with the big warheads more than compensating for any failings in reconnaissance. But if the Soviet Army is to be able to fight and win without using nuclear weapons, as might be necessary, then it must know enemy locations with greater precision. Effective reconnaissance is needed if battle in depth is to be carried out without overwhelming firepower. The Soviets will be better able to send forces through gaps in the enemy front if they know where those gaps are, to outflank enemy positions if they know where the flanks are, and to accept risks in exploitation if they know the location of enemy reserves.

The Soviets see reconnaissance and intelligence as two aspects of the same activity, placing them under the control of the chief of reconnaissance found at each level of command from regiment upwards. The responsibilities of this officer are similar to those of the NATO "G-2" staff officer, though he can also exercise operational command of all the reconnaissance and intelligence assets of the formation.

Razvedka can have applications beyond military tactics and operations. It is an element of the wider concept of *activnyye meropriyatiya* (active measures), which embraces overt, covert and clandestine political influence operations, propaganda, manipulation of foreign political parties and subnational groups, economic warfare, terrorism, and special operations in the Western sense.

The concept of *razvedka* makes no distinction between military and national intelligence. This manifests itself in a number of ways, including the fact that the KGB performs roles that in an Anglo-American army would be the province of the Intelligence Corps/Military Intelligence. There is also apparently no gap between peacetime and wartime ESM, both being the province of the Sixth Department of the GRU (Military Intelligence). The frequent reports of lorries from Warsaw Pact countries being driven in western Europe by army officers – some specialist intelligence-collectors, others representing units that would fight over that terrain in wartime – reveal a degree of meshing of functions above and beyond anything seen in the West, and probably orchestrated by the GRU's Fifth Department.

Military intelligence work and espionage have information inputs throughout the chain of command, from prisoner interrogation at company level to the KGB and GRU reporting to the highest levels of the Soviet national command authority. Naval reconnaissance will only indirectly affect army operations, unlike air reconnaissance. High-speed, high-altitude reconnaissance aircraft will be used on the directions of a front commander. The MiG-25 Foxbat (the latest model of which, the Foxbat-D, mounts a Sidekick side-looking airborne radar (SLAR) as well as electronic intelligence equipment, cameras and sensors) can overfly any point in Europe from bases in East Germany and the European USSR.

In addition to the Foxbats, other Soviet reconnaissance aircraft – still including the older Fishbed and Fitter as well as Flogger – can operate up to 450km behind the front. When used in the reconnaissance role, longer-ranged attack aircraft can extend this to 600km. The SLAR-

equipped Foxbats have a stand-off range of 150km. The turboprop Coot-A, also SLAR-equipped, has a shorter range as it operates at lower altitudes. In peacetime there are three full reconnaissance regiments in Group of Soviet Forces Germany alone, and each front will probably have at least one such regiment in support.

Using cameras, infra-red sensors and ELINT equipment, these aircraft normally operate in pairs at low altitude. Unlike most Western tactical reconnaissance aircraft, they are usually armed or escorted by fighter-bombers to attack any targets of opportunity, especially nuclear weapons or their delivery systems. Front headquarters can have the information obtained from a priority air reconnaissance mission within two hours.

In Afghanistan the Soviets have put a great deal of emphasis on reconnaissance by fixed-wing aircraft, including Foxbat. Until late 1983 at least, the only Soviet fixed-wing aircraft squadron with standing orders to attack targets of opportunity was a fighter-reconnaissance Fishbed unit based at Kabul. However, most air reconnaissance in Afghanistan appears to be carried out by twin-turboprop transports of the An-26/28/30/32 series. In use in this role since 1982–3, these aircraft have been forced up to medium altitudes by the increased Afghan use of SA-7s. They operate by day and night and include night vision equipment in their sensor suites. They can also be used as "master bombers," dropping flares to guide attacking helicopters at night, designating targets and co-ordinating attacks. Known in Pushtu simply as "the reconnaissance", they are hated and feared by the Resistance.

Electronic reconnaissance can ascertain unit locations and identity by the type of electronic activity monitored. Detection of a cluster of AFV radios, for example, may indicate an armoured unit HQ. The wide range of Soviet electronic equipment can detect artillery radars within 25km of the front line, VHF radio transmissions at up to 40km and HF transmissions at even greater ranges. HF ground waves can be intercepted at up to 80km range, HF skywave at almost unlimited range. UHF intercept capabilities also exist. Helping complete the picture is sound ranging (14km range), artillery ground radar (30km range) and surveillance radar (15km range).

Electronic intelligence aircraft give a more complete picture of the enemy electronic order of battle while standing off at long range, allowing the Soviets to destroy or avoid the emitters or prepare their countermeasures against them. Acoustic, disturbance, electromagnetic and seismic sensors are reportedly also used, but are seldom mentioned in Soviet sources.

Since the 1970s, Soviet divisional and regimental reconnaissance units have become heavier, with BRDMs replacing motorcycles for "light" reconnaissance (the motorcycles are retained for courier duties) and main battle tanks – especially the more mobile T-72s – replacing PT-76s as the "heavy" element. BMPs and BRMs have emerged as the "medium" element. This parallels the experience of other armies – such as that of the British Army in Europe in 1944–45 which have found that making reconnaissance units heavier gives them more mobility in a high-threat environment.

Operating together, the different Soviet information-gathering means can in theory provide a flow of accurate, timely information. The use of complementary and overlapping reconnaissance systems reduces the possibility of enemy deception and provides a back-up in case one reconnaissance means overlooks something of importance. However, the emphasis on anti-deception measures and redundant information may lead to an unwillingness to act on information without confirmation. For all the sophistication of information-gathering means, much is accessible only to the eyes of a soldier on the ground. Because of this, the Soviet Army puts its emphasis on trained ground-based reconnaissance units.

Long-range reconnaissance patrols

Long-range reconnaissance patrols (LRRPs) operate 50–350km forward of the main body. Motorised LRRPs are normally drawn from the long-range reconnaissance companies of divisional reconnaissance battalions, often from second-echelon divisions. Using BRDM and BRDM-RKh scout cars, these LRRPs penetrate into the enemy rear by infiltration. The furthest-ranging LRRPs are composed of paratroops or of personnel from divisional, army or front long-range reconnaissance companies, and are often inserted by helicopter or parachute.

LRRPs range from company strength to a five-man airborne team. Lightly armed, they seek to avoid action unless in furtherance of their information-gathering mission or to destroy a high-priority target. Patrols may evade combat by dispersing and regrouping or concealment. LRRP long-range radios transmit reports in speeded-up "bursts" at predesignated times to avoid enemy ELINT.

Target acquisition of enemy nuclear weapons and delivery systems is the highest-priority LRRP mission, since well-camouflaged firing sites are difficult to locate from the air. Soviet aircraft, rockets or artillery will then be used to destroy them, though in some cases the LRRP may attack the target themselves, relying on the element of surprise. LRRPs may also attack headquarters or communications facilities, or stage raids and ambushes to capture prisoners or equipment. They may also link up with airborne *desants* secret agents or GRU intelligence troops to increase their striking power and report back information. Unlike a *reydy*, however, reconnaissance remains their primary mission.

Long-range reconnaissance companies are élite units,

requiring great flexibility from their commanders. The enlisted men receive much better and more thorough training and conditioning than the average soldier; un-armed combat, wilderness survival and resistance to interrogation are all taught. LRRP assault rifles and pistols are often equipped with silencers and flash-suppressors, and the troops carry additional camouflage equipment and engineering tools for constructing patrol hiding places.

Troop reconnaissance

The Soviets believe that, given the potential lethality of modern weapons, the best tank country is that containing no anti-tank weapons whatsoever. This puts a premium not only on surprise but also on reconnaissance.

Troop reconnaissance is tactical, combat reconnaissance. An army commander will occasionally form a "reconnaissance detachment" of a reinforced battalion to operate forward of the advance combat elements of a first-echelon division but behind the patrols of the division's reconnaissance battalion. These patrols are up to a day's march – 35–50km – in front of the division. Each reconnaissance battalion will send out six to eight patrols of two to four scout cars (often two pairs) and motorcyclists, often supported by one or two tanks, with tracked BMPs or BRMs joining the patrols as required. Patrols are spread throughout the divisional sector, along the main axes of advance, on parallel routes and along the flanks, especially if a meeting engagement is expected to develop, as the Soviets depend on receiving current information from their patrols to enable them to outmanoeuvre the enemy.

Patrols will often move in pairs of vehicles, alternating rapid movement between cover with overwatching and reporting on enemy forces, terrain, road conditions and NBC contamination. Engineer squads are often attached to reconnoitre specialised objectives and remove hastily prepared obstacles along the patrol's route, BRDM-RKhs discover and mark contaminated areas. The divisional reconnaissance battalion is often reinforced by a motorised rifle company with attached tanks.

Each regiment's reconnaissance company operates in a similar way in the regimental sector, half a day's march ahead of the regiment's main body. In addition, a patrol is often the point detachment for the regiment's leading battalion(s).

On the defensive, reconnaissance patrols stay forward of the defensive zone to report the main enemy axes of advance, but they do not attempt to engage the enemy and will withdraw instead. Screening and security duties are performed by motorised rifle or tank units.

The distances between Soviet troop reconnaissance patrols and their main bodies give commanders a cushion of reaction time, enabling the Soviets to react to reports while continuing the advance. Troop reconnaissance will not be allowed to preclude surprise when other information-gathering means can be used, especially in the opening hours of an offensive.

As in other areas of tactics, Soviet reconnaissance performance in Afghanistan has frequently fallen short of pre-war protestations. Troop reconnaissance has been limited, the 1980 attempts at aggressive patrolling having been curtailed after a succession of murderously effective ambushes by the Afghans.

Motorised patrols have tended to be small and run at regular times, frequently allowing the Resistance either to avoid them or set up an ambush. In the early years of the war this approach permitted guerrillas to move close to Soviet positions or even to run supply convoys past them. By 1984, however, the Resistance had acquired weaponry and expertise that made close approaches potentially costly, so the Soviets started to re-emphasise troop reconnaissance and patrolling. This has led to an increase in the reconnaissance effort since 1984 as part of an overall build-up of *razvedka* capabilities in Afghanistan.

The extra patrolling burden is probably being borne in many cases by specialist reconnaissance troops from regiment, brigade or division level, or by independent reconnaissance units. They are sometimes used for ambush patrols but most often for target acquisition, spotting Resistance groups and convoys for artillery and air strikes.

While the Soviets' use of patrols in Afghanistan has not been as thorough or intense as that of the French in Algeria or the British in Malaya, for example, it increased in 1984–86 and will continue to be important.

Reconnaissance tactics

Unlike their Western counterparts, Soviet reconnaissance units are purely for scouting. They do not have a primary screening and security mission. NATO reconnaissance units tend to follow late-Second World War patterns: strong, often combined-arms forces, able to fight on their own for information. This is a completely different concept from Soviet reconnaissance tactics, which are reflected in their reconnaissance vehicles: light and mobile, designed to cover the long distances of their far-ranging patrols quickly and to depend on speed and concealment for protection.

When a Soviet troop reconnaissance patrol encounters the enemy it will return fire and then attempt to break contact, aided by the fire of overwatching vehicles. It will retire to the nearest cover and report the encounter by visual signal (small patrols will try and maintain visual contact with their parent units), radio or courier. The patrol will then seek to infiltrate around the enemy forces and resume its mission. It will only engage the enemy if they also appear to be a reconnaissance patrol, or if the Soviets have the advantage. If required, ambushes and

"silent" or "combat" raids will be made to take prisoners.

Soviet troop reconnaissance patrol tactics are aggressive, even if they do not normally accomplish their mission by battle. Once the enemy is encountered, the Soviets will not simply observe from cover but will press on to their objectives or, if required, maintain observation of an enemy unit. Observation posts will be established during reconnaissance missions to provide early warning of enemy movement, direct supporting fires and monitor NBC effects. However, most Soviet reconnaissance is performed from the scout vehicles, although vehicle crews and the light machine gun and RPG-7-armed scout teams carried by most scout cars will dismount when necessary.

Combat reconnaissance patrols are troop reconnaissance patrols sent out by a tank or motorised rifle unit, often as a point detachment. They are used when action is expected, or when contact with the enemy must be maintained, as in a pursuit. Any patrol will however use reconnaissance by battle or probing attacks if necessary to accomplish its mission, usually covered by overwatching vehicles, or a patrol or a single vehicle or motorcyclist can be ordered to engage or approach the enemy in a probing attack to determine weapon strengths and locations; the inevitable losses are high even by Soviet standards. Soviet patrols will also use reconnaissance by fire, to force the enemy either to withdraw or return the fire. Reconnaissance in force is conducted by tank and motorised rifle units, and the Soviets distinguish it from the probing attacks and reconnaissance by battle that all units perform. While the reconnaissance in force was widely used in the Second World War, it is less emphasised today. It involves collecting information by launching an attack that the enemy believes is a full-scale offensive, a costly process and one which may make it impossible to achieve surprise in later attacks. Reconnaissance in force is most often used in urban or wooded terrain.

Command reconnaissance

The whole spectrum of Soviet reconnaissance is valueless if it cannot be acted upon by the field commanders. The use of forward command posts and command observation posts allows the commanders to be on the spot at crucial moments, though the Soviets do not rely so much on the personal action of the commander as on his detailed plans and instructions to his subordinates. Soviet command tends to "push" more than "pull". Nonetheless the Soviets realise that there is no substitute for direct front-line leadership. A command reconnaissance is almost always made before a breakthrough attack or any attack in dense terrain. Often a commander will not commit his second echelon or reserve until he has examined the battlefield personally. Defensive weapons siting is often determined by a command reconnaissance.

Reconnaissance effectiveness

Soviet army troop reconnaissance is relatively straightforward. Compared with the activities of Western units, it depends less on radar and sensors and more on direct visual observation. While this makes Soviet troop reconnaissance less susceptible to countermeasures, it does give patrols less flexibility and may well result in more exposure and higher losses than would be the case if they had a greater radar/sensor capability in individual patrols. Unless reconnaissance units have avoided the widespread Soviet problems with maps and map-reading, they will find their capabilities undermined. Similarly, the junior officers and NCOs who will lead the reconnaissance patrols will be called upon to demonstrate flexibility and initiative well above the average, yet these are qualities that have often been in short supply amongst such people. Unless the Soviets deliberately put their better men in reconnaissance units, they may not be able to use their mobility to the best advantage. Despite these limitations the Soviets realise the importance of reconnaissance, and have attempted to adapt their tactics to reflect this and to reduce the effect of any limitations.

The general lack of Soviet battlefield success throughout the Afghanistan war can be attributed largely to reconnaissance limitations. For much of the war the Soviets have seemed to lack the ability both to gather reconnaissance information and to react to it. Since about 1983–84 they have made an effort to build up a broad reconnaissance network. Human intelligence plays a prominent part: DRA secret police informers are the most effective tool in this campaign. The Air Force provides reconnaissance jets, twin-turboprops and helicopters, with the last becoming less aggressive in 1986–87. Airborne reconnaissance is comprehensive, although the use of predictable patrols until 1985–86 reduced its effectiveness in many areas.

Army patrols are often inserted by parachute or helicopter into areas in which the guerrillas move freely. Surveillance radars and radio direction-finding units are used. ESM is employed to locate guerrilla radios, although on at least one occasion the Resistance, knowing that the transmitter had been detected, ambushed and shot down a Hind that arrived to attack the site. But the elements most feared by the Resistance continues to be the network of spies and informers run by the Soviets and the DRA. There was seldom a war in which both sides were so thoroughly infiltrated.

The future

The question of what will replace the BRDM-2, as both a light reconnaissance vehicle and a chassis for specialised roles, is the "missing link" among Soviet reconnaissance systems. There have been unconfirmed reports of an

eight-wheeled diesel-powered amphibious vehicle, possibly a version of the BTR-80.

The recent emphasis on deep operations and longer-ranged conventional weapons will probably lead to a corresponding effort to field deep reconnaissance systems. This may include the development of direct satellite targeting for surface-to-surface missiles, as is believed to be planned for the Navy's SS-N-19 SSM.

Soviet remotely piloted vehicles (RPVs), mostly large and fast, are becoming smaller and more agile, like those used by Western armies. Indeed, such drones are already in Soviet service. The advantages of such systems were probably made plain by the 1982 Lebanon War, with the result that Soviet reconnaissance units may have an improved RPV capability by the late 1980s or early 1990s.

The Soviets will probably make greater use of helicopter reconnaissance. This has already been seen in Afghanistan. Less technology-dependent than satellites, RPVs or sensors, helicopters would meet the reconnaissance needs of deep-strike weapons and OMGs.

Similarly, the use of long-range reconnaissance patrols by special forces – a relatively low-technology, low-cost solution to the problems of reconnaissance and targeting in the operational depths of the enemy rear for conventional, chemical and nuclear delivery systems – is likely to increase.

Unit organisation

Regimental reconnaissance company (tank and motorised rifle regiment)

Total strength: four or five officers, 43–57 enlisted men, three BMPs, one BRM-1 with Tall Mike, four BRDMs, three to five motorcycles, one PSNR-2 radar, one Ural-375.

One company HQ
One BMP platoon
One BRDM platoon
One motorcycle section

Divisional reconnaissance battalion (tank and motorised rifle division)

Total strength: 373 personnel

One headquarters and support company (70 personnel, one BRM-1 with Tall Mike, two BTR-60PU or BRDM-U, one VHF/UHF ESM intercept receiver, one battlefield surveillance radar, two command vans, four jeeps, nine trucks, two POL trucks, one maintenance van, one ambulance).

One light reconnaissance company (80 personnel)
One company HQ (1 BRDM-2U)
Two scout platoons (six BRDM-2 each with dismounted scout teams)
One motorcycle platoon (24 motorcycles)

Two heavy reconnaissance companies (55 personnel)

Each with one company HQ (one BRM-1 with Tall Mike, two BRDM-2RKh, RKhM or other NBC reconnaissance vehicle, one GAZ-66 carrying battlefield surveillance radar)

Two reconnaissance platoons (three BRMs or BMPs, each with dismounted scout teams with RPGs, LMGs, SA-7/14s)

One tank platoon (three main battle tanks)

One radio/radar reconnaissance company (80 personnel, eight VHF/UHF intercept receivers, three HF/VHF/UHF truck-mounted radio directionfinders, three jeep-mounted Pole Dish radar directionfinders, one jeep, two command vans, 13 GAZ-66 ESM vans, six vans, one maintenance van)

One company headquarters
One radio-intercept and DF platoon
One radar-intercept and DF platoon
One air-ground intercept and DF platoon
One maintenance platoon

One long-range reconnaissance company (six officers, 27 enlisted men)

HQ section (one officer, two enlisted men)
Five reconnaissance teams (each of one officer, five enlisted men)

Scout cars

Introduced in 1951, the BTR-40 is a four-wheel-drive scout car built on the chassis of the GAZ-63 truck, the hull design being an up-armoured improvement of that on the US-built White scout car. Design work, by the Dedkov bureau at GAZ, started in 1947, with the aim of producing a squad-carrying vehicle that could also serve as a platform for twin 14.5mm guns and as a complement to the bigger BTR-152. Its Soviet nickname is *Sorokovke* ("Little Forty"). Throughout the 1950s the BTR-40 design was refined in a number of versions. The basic open-topped BTR-40 was armed with a pedestal-mounted 7.62mm SGMT machine gun. The BTR-40B featured overhead armour and two gun ports on each side of the passenger compartment. The BTR-40A was an anti-aircraft version with twin 14.5mm guns, mainly used for export. The East Germans have retrofitted some of their BTR-40s with a Sagger launcher under a retractable roof, similar to that on BRDMs. The BTR-40RKh was the NBC reconnaissance version of the BTR-40B, with monitoring equipment and an automatic flag-planting device to designate clear lanes. Like all BTR-40s, it had no NBC defence system; the crew had to rely on their protective suits. The BTR-40 lacked the cross-country mobility required by a scout car, it was not amphibious and lacked a tyre pressure regulation system. Despite its age, the BTR-40 was still in service in the Group of Soviet Forces Germany in 1979. They are also widely used by the Commandant's Service (military

Scout cars

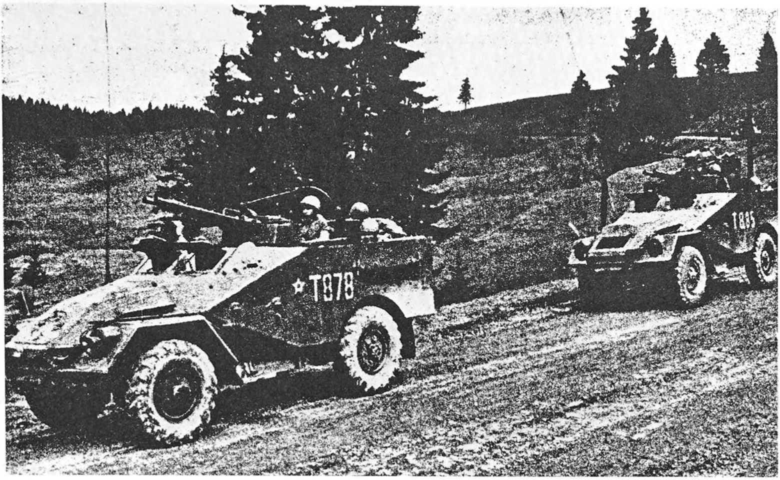
Vehicle	BTR-40	BRDM-1	BRDM-2
Combat weight	5.3 tonnes	5.6 tonnes	7.0 tonnes
Length	5.0m	5.7m	5.75m
Width	1.9m	2.225m	2.35m
Height	1.75m	1.9m	2.31m
Wheelbase	2.7m	2.8m	3.1m
Track	1.6m	1.6m	1.84m
Clearance	0.275m	0.315m	0.335m
Tyre size	9.75 × 18	12.00 × 18	13.00 × 18
Max road speed	80km/h	80km/h	100km/h
Max water speed	nil	9km/h	10km/h
Fuel capacity	120 litres	150 litres	290 litres
Fuel consumption	0.42 litres/km	0.3 litres/km	0.35–0.45 litres/km
Range (paved road)	285km	500km	750km
Fording	0.9m	swims	swims
Gradient	30°	30°	30°
Vertical obstacle	0.47m	0.4m	0.4m
Trench	0.7m	1.22m	1.25m
Engine	GAZ-40 6-cylinder in-line, 80hp, petrol, water-cooled	GAZ-40P 6-cylinder in-line, 90hp, petrol, water-cooled	GAZ-41 V-8, 140hp, petrol, water-cooled
Horsepower/weight	15.09hp/tonne	16.07hp/tonne	20.0hp/tonne
Main gun	7.62mm SGMT	12.7mm DShKM	14.5mm KPV
Secondary gun	nil	7.62mm SGMB/PKT	7.62mm PKT
Main gun ammunition	1,250 rounds	1,250 rounds	500 rounds
Secondary gun ammunition	nil	1,250 rounds	2,000 rounds
Main gun elevation	−6°/+23.5°	−6°/+23.5°	−5°/+30°
Main gun traverse	90°	90°	360°
Armour (overall)	8mm	10mm*	10mm*
Crew	2	2	2
Max passengers	8	3	6

* Detailed armour for BRDM-1 is: upper hull front 5mm @ 80°, lower hull front 7mm @ 45°, hull rear and sides 7mm @ 0°, hull top 7mm, belly 3mm; superstructure: front 10mm @ 50°, sides 10mm @ 30°, rear 7mm @ 60°, top 4mm; MG mantlet 4mm @ 90° where fitted, nose plate 14mm @ 40°. All TMT rolled-steel armour.

BRDM-2 is as BRDM-1, with the addition of turret with 7mm of armour @ 40° all around and 7mm top. Some BRDM-2s mount a BTR-80 turret with improved elevation.

police) and paramilitary organisations in low-readiness areas, despite production having halted in 1958–60. One Soviet version that probably remains in use with the Army and possibly the MVD Internal Troops is the BTR-40ZhD. Introduced in 1969, this has a convertible suspension enabling it to accept flanged wheels and operate on rail lines. The BTR-40 remains in service as a general-purpose light AFV throughout the Third World.

The BRDM-1 (*Bronevaya Razvedyvatelnaya Dozornaya Mashina*, armoured reconnaissance patrol vehicle) was introduced in the spring of 1959, replacing the identical but open-topped BRDM (designed by the Dedkov bureau), which was introduced in 1957 but saw only limited production and use. The BRDM-1 rectified many of the failings of the BTR-40. Engine horsepower was increased, although the new vehicle retained the front-mounted petrol engine of the BTR-40. The BRDM incorporated many components of the GAZ-63 truck. The boat-like hull and alligator nose of the BRDM-1, similar to those of the MAV amphibious trucks, are designed for swimming, the vehicle being propelled by a single water-jet and using a bow vane for stability. Cross-country mobility was increased by the provision of the standard Soviet internal tyre pressure regulation system, and by two pairs of small-diameter belly wheels. Normally kept retracted in the chassis, these can be lowered from inside the vehicle to aid in traversing rough terrain without impeding high speeds on roads. They also aid flotation. The BRDM-1 is fully enclosed, although the main armament – a pintle-mounted 12.7mm DShKM (omitted on many BRDM-1s) and 7.62mm SGMB or PKT machine guns – cannot be fired from under armour. Six firing ports



BTR-40A scout cars of the Hungarian Army. *(Tom Woltjer)*

BRDM-1 armed with a 12.7mm DShKM and 7.62mm SGMB. *(US Army)*

BRDM-2s at the edge of a burning river. The extended trim vanes and the open water-jet housings show that they are about to enter the water. The black canvas bags on the rear decking are for equipment storage. The whip-type aerials indicate that these vehicles have long-range radios, as used in reconnaissance BRDMs. *(US Army)*

– two in each side and two in the rear – allow passengers to use small arms.

A retractable triple Snapper or quadruple Swatter-A or Sagger mount was fitted into the passenger compartment of some BRDM-1s used by regimental anti-tank companies. The armoured roof could be raised and the ATGMs made ready for action within one minute. The BRDM-1U headquarters version is recognisable by its four antennae and additional generator. The BRDM-1RKh NBC reconnaissance version has an NBC protection system and an improved range of sensors. Soil samples can be automatically gathered and brought into a shielded compartment for analysis. The sensor suite normally includes a DP-3B nuclear area survey meter, a DP-5A radiac meter, a KPO-1 biological agent sampling kit, and PPKhR and VPKhR chemical sampling kits. Crews of NBC reconnaissance BRDMs are also trained in dismounted analysis of NBC effects and to use sensor devices. Marking flags are dispensed from two box-like devices on the rear deck.

The BRDM-1 may remain in Soviet service for some years to come, 8,500 being produced for Soviet service in 1958–68 in addition to 1,500 for export. But the primary scout car is the BRDM-2. Sharing the all-welded steel construction of its predecessors, the BRDM-2 is a much more conventional design than the BRDM-1. An improved V-8 petrol engine (two small petrol engines, like the BTR-60's, in early examples) is mounted in the rear of the vehicle, eliminating the BRDM-1's "snout" and reducing vulnerability. The BRDM-2 retains the central tyre pressure system and the retractable belly wheels. It mounts the same turret as the BTR-60PB, with 14.5mm KPV and 7.62mm PKT machine guns, and there is a firing port and vision block on each side of the passenger compartment. The commander sits in the turret and acts as gunner, while the driver is in front; in the BRDM-1 the two sat side by side.

The BRDM-2RKh is an improved NBC reconnaissance version with the same flag-planting, soil-sampling and environment-monitoring capabilities as its predecessors. There are two variants of this vehicle, one with a modified 7.62mm turret also containing a small sensing port, the other with the standard turret. The command version, the BRDM-2U, has the turret removed to provide more room for a commander and staff. Additional radios and a generator are carried. In wide-spread use throughout the Soviet Army, this version is a standard command observation post or forward command post for Soviet units, although standard BRDM-2s are also used in these roles.

There are at least three variants of the BRDM-2U, characterised by different generator and hatch arrangements. The most common of these features a generator in a

metal container in place of the turret. Another has the generators mounted in the rear, and the third has no generators and a hatch in place of the turret.

Some BRDM-2s used by long-range reconnaissance companies have high-power, long-range radios equipped for "burst" transmission or radio direction-finding equipment; all of these units' BRDMs carry external petrol tanks and jerrycans stowed internally. Because of its widespread use and large internal space, the BRDM-2 is an excellent choice as a weapons platform. Those of regimental anti-tank companies are armed with a retractable sextuple Sagger launcher or five Spandrel launch tubes in place of its turret, the latter vehicle reportedly being designated BRDM-3. The Sagger launch vehicle carries eight reload rounds, and the Spandrel carrier is believed to carry 10. The SA-9 Gaskin quadruple SAM mount is on a BRDM-2 chassis and hull. BRDM-2s also mount radars, jammers, communications systems, target designators and other weapons.

In addition to their two-man crews, BRDM-2s in reconnaissance units often carry a two-man scout team armed with a light machine gun and RPG-7 or 16. In winter these teams can operate on skis which are stowed externally on the BRDM. A two-man team with an RPG-7/16 rides shotgun in each Sagger-equipped BRDM, providing close-range defence against armour or, using their rifles, protecting the BRDM commander when he is firing the ATGMs while dismounted.

The radios fitted to a BRDM depend upon its function. Each will have at least a basic R-123M set. In addition a battalion command BRDM-2U will have an R-107 set to communicate with company commanders and specialist or combat support units, an R-311 set for air and NBC threat warnings, and an R-130 to communicate with tank battalion and company commanders. An R-126 radio for dismounted use will also be carried on board. A BRDM used as an artillery command observation post would have an R-104M set to contact the parent battalion, and an R-108M set to keep in contact with the battery and gun positions if it is not co-located with them. Replacement of these radios with more modern equivalents began in the 1970s.

The different versions of the basic BRDM-2, another Dedkov bureau design, are marked by changes in the air intake covers, progressing from opening hatches via a slatted grill to six oval mushroom intakes that limit leakage when swimming.

About 19,000 BRDM-2s were produced from 1966 to the early 1980s, chiefly at the Gorkii works; half were specialised versions and 4,500 were exported.

Optics have improved throughout the development of Soviet scout cars. Although it is absent from the BTR-40, all BRDM-2s and some BRDM-1s feature the TVN-2 infra-red night driving system. As in the BTR-60PB, the 14.5mm KPV machine gun can be fitted with a PPN-2 400m-range night sight. Both BRDMs use the same vision block system as the BTR-60PB. All BRDM-2s apparently use the same land navigation system as the T-62 command tank.

Egypt used BTR-40s in 1956. In 1967 both the Egyptians and Syrians had numbers of BTR-40s, BRDM-1s and a few BRDM-2s, but no ATGM-armed versions of any of these. Many were captured by the Israelis, the BRDM-1s being used by Israeli raiding forces and the BTR-40s being rearmed with Israeli weapons and radios and used by the Border Police. Both the BRDM-1 and BRDM-2, including Sagger-armed BRDM-2s, were used in the 1973 War. Some captured vehicles went to the USA. All three Soviet scout car designs are used in Angola, and BRDM-1s of the Ugandan Army attempted to defend Kampala in 1979. BRDM-2s have also been used in Ethiopia and in Afghanistan.

MT-LBu/KShM ACRV

Weight 14 tonnes **Length** 6.3m **Width** 2.8m **Height** 2.3m **Ground pressure** 0.45kg/cm² **Crew** 5 **Max speed (land)** 60km/h **Max speed (water)** 5km/h **Range** 500km **Vertical obstacle** 1.1m **Engine** YaMZ-238V diesel, V-8, 240hp **Fuel** 550lit **Gun** 12.7mm or 7.62mm, pintle mount, 360° traverse **NBC protection** PAZ (including filter) **Armour** Hull 15mm max; turret 20mm max (estimated) **Night vision equipment** on -2 version **Soviet designations** 1V1 to 1V12

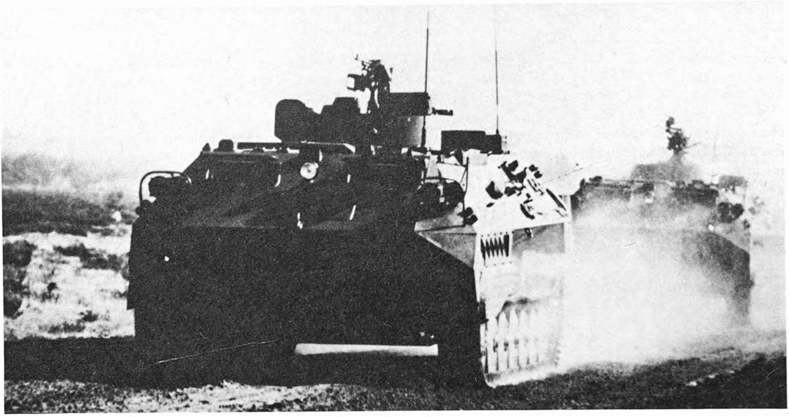
Soviet designation of the ACRV M-1974 (NATO designation Armoured Command and Reconnaissance Vehicle) is MT-LBu or KShM (*Komando-Shtabnoy Mashina*, Command and Staff Vehicle). It has been replacing the less mobile adaptations of trucks and APCs used in the past in a variety of roles, especially those relating to artillery and command. It is also used more for what the Soviets define as "artillery reconnaissance" than for reconnaissance in the Western sense.

The ACRV was developed from the MT-LB and the chassis of the 2S1 122mm SP howitzer. The hull is large and boxy, and is fitted with complete NBC and land navigation systems and a rear-mounted generator. There is a circular turret on the rear of the hull.

There are three major versions, each with a different tactical mission and equipment fit:

M-1974-1

Artillery battalion and battery fire-direction vehicle, co-located with the gun positions. Equipped with radios to communicate with the COPs, it is armed with a 12.7mm DShKM on the turret roof. Scale of issue is one per



battalion and battery equipped with SP artillery. It has manual fire-direction equipment. Equivalent to ACRV M-1979-1, a GAZ-66 van used with towed artillery.

M-1974-2
Battalion or battery command observation post vehicle, with manual fire-direction equipment. The turret – with a 7.62mm PKM on the roof – contains an optical rangefinder and a DAK-1 Sage Gloss dismountable laser rangefinder; it also probably has image-intensification equipment. This version can be recognised by the laser box on the turret side, plus a box on the right-hand side of the hull and small boxes on the turret roof. Each battalion and battery commander in an SP artillery regiment has one -2. Equivalent to ACRV M-1979-2, a BTR-60PU used with towed artillery.

M-1974-3
The most sophisticated of the major versions, used at battalion and higher levels for fire direction. In Soviet artillery practice the battalion chief of staff stays with the guns, while the CO is forward with supported units in his M-1974-2. Issued one per battalion, Type 3s are also found at artillery regiment HQ. This version is believed to have digital fire-control computers, possibly backed up by manual fire-direction equipment. Equivalent to ACRV M-1979-3, a ZIL van used with towed artillery.

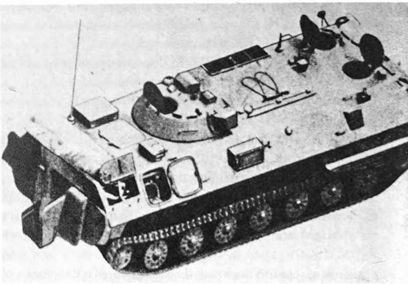
The Type 3 has three or four radios, the other types two or three. All ACRVs can mount a 12.7mm or 7.62mm machine gun, but only the Type 1 usually does. All types probably have high-speed data-link equipment.

The Soviets identify 12 sub-types, 1V1 to 1V12.

Combat usage and tactical employment

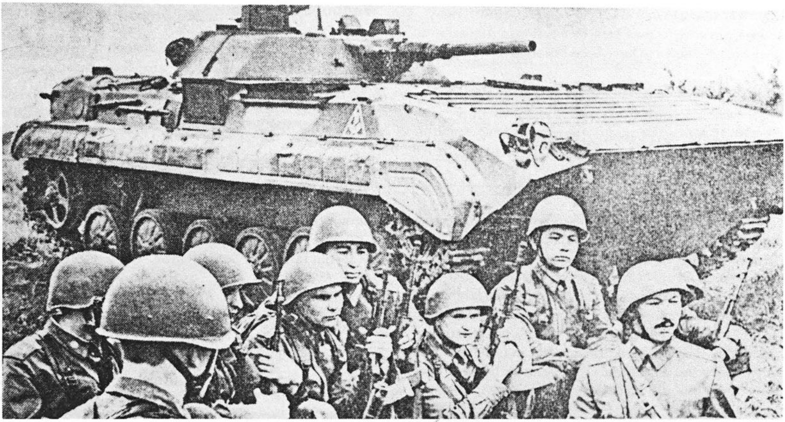
The ACRV has seen combat with Soviet SP artillery units in Afghanistan. It has been exported only to Warsaw Pact armies.

An ACRV Type 3, with laser rangefinder below and to the left of its external machine gun, leads a Type 1.



An ACRV Type 2, identifiable by the boxes on the right hull side. Battalion COPs have a 10m telescoping antenna. *(US Army)*

The ACRV series helps make possible many of the improved tactics of the Soviet artillery. Working with other vehicle-mounted target-acquisition systems such as the Small Fred and Big Fred radars and Pole Dish ESM system, as well as MT-LBs carrying computers at regiment and higher level, it gives cross-country mobility to systems that, in towed artillery units, are generally kept in unarmoured vans. The use of data links between ACRVs forward with the COPs and back with the guns would increase responsiveness.



BRM-series reconnaissance vehicles

Weight 14.5 tonnes **Length** 6.75m **Width** 2.94m **Height** 1.9m **Crew** 4 **Passengers** 2 **Ground Clearance** 0.4m **Ground pressure** 0.59kg/cm² **Max speed (land)** 80km/h **Max speed (water)** 10km/h **Max range** 500km **Max gradient** 32° **Trench** 3.2m **Vertical obstacle** 0.52m **Engine** 5D20 diesel, 6-cylinder, 300hp **Fuel** 460lit **Main gun** 73mm (as BMP-1) **Co-axial gun** 7.62mm (as BMP-1) **NBC protection** PAZ **Radios** R-123, R-130, R-107 **Main-armament elevation** −5°/+30° **Turret-front armour** 23mm @ 35° **Hull-front upper armour** 7mm @ 78° **Hull-front lower armour** 13mm @ 80° **Night vision equipment** IPN22MI image-intensifier, 1,000m range

Data apply to BRM. BRM-1 has 73mm main armament and 7.62mm co-axial machine gun, BRM-2 has 30mm cannon (as BMP-2). Other variations, relating to weight and performance, are unknown. Armour, like that of BMP, is made of electro-slag remelted steel.

The BRM, BRM-1 and BRM-2 (*bronirovannaya razvedivatelnaya mashina*, armoured reconnaissance vehicle) were developed from the BMP-1, and are also known as the BMP-R or BMP M-1976.

The basic BRM was introduced in the early 1970s. It differed from the standard BMP in having a large, two-man turret, although retaining the basic armament of a 73mm gun and Sagger ATGM. The troop compartment was reduced in size to accommodate only a two-man scout team, resulting in two roof hatches rather than the BMP's four. The BRM has additional radios, with a folding, telescoping antenna over the rear doors for long-range transmissions.

BRM reconnaissance vehicle.

Most production BRMs lacked the Sagger ATGM launchers of the initial production vehicles. The BRM-1, also known as the BMP M-1976/2, first appeared in the late 1970s. It was distinguished by a 10km-range Tall Mike battlefield surveillance radar on the upper rear of the turret. It retains its 73mm armament.

The BRM-2, a 30mm-armed version, is reported to have entered service by the early 1980s; armament is the same as that of the BMP-2. The BRM-2 was reported to be in service in East Germany in 1986.

Tactical employment

The BRM was initially used alongside standard BMPs in divisional and regimental reconnaissance units. It has since emerged as the standard medium reconnaissance vehicle, replacing the BRDM-2, which has become the light reconnaissance vehicle. BRMs carry much of the burden of Soviet troop reconnaissance, with main battle tanks providing overwatch and operating in heavy-threat areas. BRM-1s are used by company and battalion commanders, while medium scout platoons consist of three BRMs (or, presumably, BRM-2s). As with the BRDM, BRM crews will try to stay concealed whenever possible, using dismounted scout teams from defilade positions. They will fight for information only when absolutely necessary; their heavier armament would make them more effective in such combat.

Combat usage

BRM-series vehicles may have seen action in Afghanistan. They are not known to have been exported.

Sofia Vehicle (M-1984)

Weight 15 tonnes **Crew** 3 **Passengers** Rifle squad or scout team **Armament** As BMP-2 **Chassis** As 2S1 SP howitzer

First paraded by the Bulgarian Army in September 1984, the Sofia Vehicle combines the hull and chassis of the 2S1 122mm SP howitzer with the turret of the BMP-2 M-1981, armed with a 30mm cannon, co-axial PKT machine gun, Spandrel ATGM and six smoke mortars. The larger hull would give more room for a dismounted scout team than the BRM-1, and provide better buoyancy when swimming. It is probably not a Soviet design, but may be of Polish rather than Bulgarian origin, as the Poles are believed to be producing both the 2S1 and the BMP-2. Combining elements of these vehicles is certainly within Polish capabilities. The Sofia Vehicle could also be intended as an infantry combat vehicle.

Weapons effectiveness and combat usage

The Sofia Vehicle has never seen combat and it is not known to have been used by any country other than Bulgaria. Weapons effect is the same as that of the BMP-2.

Tactical employment

The Sofia Vehicle may be either a low-cost infantry fighting vehicle or a reconnaissance vehicle. Only if it is the second is it likely to be in Soviet service. Fielding a 30mm-armed reconnaissance vehicle is a logical action. It is possible that the BRM-2 is not actually an upgunned BRM, but rather the Sofia Vehicle.

The Sofia Vehicle may be the BRM-2 or a Czech, Polish or even Bulgarian hybrid. Its role may be either reconnaissance or infantry fighting vehicle.

PT-76 amphibious tank

Combat weight	14.0 tonnes
Length (gun forward)	7.63m
Length (gun rear)	6.91m
Width	3.14m
Height	2.26m (2.195)*
Width	3.14m
Track	2.74m
Clearance	0.37m
Track width	0.36m
Ground contact	4.080m
Ground pressure	0.479kg/cm²
Max road speed	44km/h
Max water speed	10km/h
Fuel capacity	250 litres
Fuel consumption	0.96 litres/km
Gradient	30°
Range (road)	260km
Range (water)	100km
Vertical obstacle	1.1m
Trench	2.8m
Engine	6-cylinder in-line water-cooled diesel, 240hp @ 1,800rpm
Transmission	mechanical synchromesh, 5 forward, 1 reverse gears
Horsepower/weight	17.14hp/tonne
Main gun	76.2mm D-56TM (D-56T)
Calibre length	42cal
Rate of fire (claimed)	15rpm
Rate of fire (actual)	4–6rpm
Maximum range	12.1km (indirect fire, on incline)
Point-blank range (2m-high target)	APHE = 820m HVAP = 1,000m HEAT = 500m (BP-353)
Ammunition types	OF-350 Frag-HE, BR-350B APHE, BR-354P HVAP, BP-353/UBP-350M spin-stabilised HEAT, BK-354R fin-stabilised HEAT
Muzzle velocity	HE = 680m/sec APHE = 655m/sec HVAP = 965m/sec
Shell weight	HE = 6.2kg APHE = 6.5kg HVAP = 3.1kg (BR-354P) HEAT = 4.0kg (BP-353/ UBP-350M)
Ammunition load	40 rounds
Co-axial MG	7.62mm SGMT
MG ammunition	1,000 rounds
Main gun elevation	−4°/+30°
Traverse	360°
Armour (glacis)	11mm @ 80°
Armour (hull side)	14mm @ 0°
Armour (mantlet)	11mm @ 30°
Crew	3
Radio	R-123, plus R-112 in company command tanks

* Figures in parentheses are for PT-76 initial production; otherwise as standard. Detailed armour is: lower hull front 14mm @ 45°, hull rear upper 7mm @ 0°, hull rear lower 7mm @ 45°, top 7mm, belly 5mm, turret front 17mm @ 35°, turret sides 16mm @ 35°, turret rear 11mm @ 35°, turret top 8mm.

The PT-76 (*plavuchii tank*, amphibious tank) is being phased out of Soviet service. Largely replaced by main battle tanks in reconnaissance units at divisional level, the PT-76 is still in service with the Naval Infantry, in low-readiness divisions, and with units in areas where its low weight and swimming capability would be useful.

Prototypes started trials in 1952, and large-scale deliveries began in 1955. The design emphasised amphibious capability, and armament and mobility were adequate by early-1950s standards but armour protection was light. The PT-76 is of conventional all-welded steel construction, having torsion-bar suspension and six road wheels with the drive sprocket at the rear and the idler at the front. The rear-mounted straight-six water-cooled diesel is half of the V-12 engine of the T-54. The front-mounted transmission has suffered a number of problems, leading to poor acceleration.

Internally the PT-76 is less cramped than most Soviet tanks, although almost half its space is taken by the engine compartment, which is separated from the crew compartment by an armoured bulkhead. As in the T-34 (and unlike most Western tanks), no bulkhead separates the driver from the rest of the crew compartment. The PT-76 has a turret cage and basket. Communication is by an R-123 radio, and company command tanks also carry an R-112. The PT-76 lacks a navigation system, NBC protection system and NBC monitoring equipment, important omissions in a reconnaissance vehicle. It has an infra-red driving light and a standard white-light searchlight (retrofitted to earlier models), and can make smoke by injecting diesel fuel into the exhaust.

The Soviets felt the lack of amphibious armour throughout the Second World War, and the PT-76 was intended to be able to provide mobility in the

An early-production PT-76 with a D-56T gun (recognisable by its multi-baffle muzzle brake) in Prague in 1968. The white "invasion cross" is used when combat against similar types of tanks is possible, and to identify opposing forces on manoeuvres. Soviet inventory of PT-76s was estimated at 1,330 in 1986. *(US Army)*

reconnaissance role and armour support during river crossings and amphibious landings. Water propulsion is by two stern-mounted hydrojets. Two intake ports, covered by clam-shell covers when not in use, are opened in the bottom of the hull. Pumps driven by the engine pull water into these openings, and it is expelled under pressure from the hydrojets. Steering is achieved by varying the amount of water taken into each intake. A deflector vane on the front of the tank is raised for stability while swimming. The PT-76's swimming ability leaves much to be desired, its surf and rough-water capabilities being inferior even to those of the BTR-60PB. Early PT-76s could be left dead in the water by waves drowning the engine, but most now use a snorkel while swimming. However, they can still lose power or sink. It is hard to keep a PT-76 on course while swimming. The raised trim vane, waves and spray block most of the driver's view, and he must rely on the commander's directions. It is also difficult to fire the gun while swimming. If the gunner's view is obscured the commander must determine the range (although he lacks a rangefinder on his binocular viewing device, which is similar to that on the T-54), aim the gun while allowing for the roll of the waves, and give the order to fire from the turret. It is often hard to observe the burst of shell because spray and oil film fog the vision devices. To minimise this a protective shield, electrically connected to the gun-firing mechanism, covers the vision and optical devices at the moment of firing, uncovering them in time to observe the fall of shot.

The early production model's D-56T gun has a slotted muzzle brake and no bore evacuator. Most PT-76s mount an unstabilised D-56TM gun with a double-baffle muzzle brake and a bore evacuator. The PT-76B has a two-plane-stabilised D-56TS 76.2mm gun and an NBC filtration system. The PT-76 chassis has been used as the basis of a wide family of Soviet vehicles: the ASU-85, ZSU-23-4, SA-6 missile and radar vehicles, BTR-50, BMP, early FROG missile transporters, GSP heavy amphibious ferry and many others. Many of the components first used in the PT-76 were adopted as standard for other Soviet vehicles.

The D-56T and the slightly improved D-56TM are ballistically identical and can fire all Soviet 76.2mm ammunition. Based on the wartime 76.2mm tank gun, the D-56 series has a vertical sliding-wedge breech block and a hydropneumatic recoil system. Elevation is manual. A rate of fire of 15 rounds per minute has been claimed, but there is no loader – the gunner must load and fire – and four to six rounds per minute is a more probable maximum figure. The optics, both the commander's binocular sight and the gunner's TSh-66 telescopic sight, are similar to those on the T-54. The PT-76 does not normally mount a night sight. The sight has reticles only for machine gun, Frag-HE and APHE ammunition. Use of HEAT and HVAP ammunition must rely on firing tables or estimation.

About 7,000 PT-76s, 2,000 of them for export, had been built at the Kirov works at Leningrad and the Volgograd tractor factory by the time production ceased in 1967–69.

Weapons effectiveness and combat usage

Despite its age, the D-56T is reportedly an accurate weapon, especially at short ranges. The following table gives the probability of a first-round hit from a standing PT-76 against a standing AFV:

Ammunition	Range (metres) 50	100	175	250	500	750	1,000	1,500	2,000	2,500
HVAP BR-354P	97%	89%	89%	89%	86%	83%	68%	39%	17%	0%
HEAT	97%	83%	83%	83%	83%	75%	61%	33%	3%	0%

These figures are from the US Army, which has had a number of PT-76s for many years.

Penetration against flat, vertical steel armour

Ammunition	Range (metres) 500	1,000	1,500	2,000
APHE	69mm	61mm	54mm	48mm
HVAP BR-354P	92mm	58mm	?	?

The older, spin-stabilised BP-353 or UBP-350M HEAT rounds could penetrate 120mm of oblique, homogeneous armour at any range; the newer fin-stabilised BK-354R can penetrate 280mm.

The HEAT or HVAP round has approximately a 33% chance of killing an M60A1 tank and a 50% chance of killing a lightly armoured vehicle such as an M113 or M109.

At close range the 76.2mm gun can breach the walls of all but the most impregnable buildings in four (for light buildings) to nine hits.

Polish-made PT-76s have a 12.7mm anti-aircraft machine gun.

The PT-76 saw action in Kashmir in the 1965 India-Pakistan War. Egypt used PT-76s in 1967 without much success. The Israelis used captured PT-76s in a number of raids against Egypt during the War of Attrition. In 1973 Egyptian and Syrian patrols with PT-76s made the deepest penetration of the war. PT-76s also equipped part of the Egyptian 130th Mechanised Infantry Brigade which swam the Great Bitter Lake on the first day of the war and advanced into Sinai, only to be overrun by Israeli tank reserves hurrying to the front. There are reports that the Israelis also used PT-76s in special operations.

The PT-76 entered combat in Vietnam in the pre-dawn darkness of February 7, 1968. Eleven PT-76s of the 68th Armoured Regiment, supported by two battalions of North Vietnamese regulars, surprised and overran the Special Forces camp at Lang Vei. The US LAW anti-tank weapon was found to have reduced effectiveness against the PT-76, the flotation spaces of which apparently functioned as spaced armour. Losses were however still heavy, as they have been whenever the PT-76 has been used as a main battle tank. PT-76s of the 68th and 203rd Armoured Regiments fought throughout I Corps area in 1968–69, and were reinforced with other tank units for the 1972 offensive. Other North Vietnamese PT-76s were used in the Laos invasion and served as main battle tanks – without infantry support – in the battle of An Loc in 1972, when they were defeated.

Also used in Vietnam was the Chinese Type 63 light tank, an upgunned version of the PT-76 which weighs 18 tonnes and mounts an 85mm gun. Along with standard PT-76s, it is used as a reconnaissance vehicle by the Chinese Army.

The Indian Army used PT-76s successfully in the 1971 war with Pakistan. In the waterlogged country of Bangladesh PT-76s were used for many cross-river operations, some swimming long distances to outflank Pakistani resistance. The Indians like the PT-76's amphibious capability, simplicity and light weight, which allow it to go where other Indian armour cannot reach.

Tactical employment

The PT-76's main role was, before it was supplanted by main battle tanks as the heavy element of Soviet mechanised reconnaissance subunits, to act in support of troop reconnaissance patrols, often supporting BRDMs from overwatch positions. If strong positions are to be scouted or the terrain is not suitable for scout cars, PT-76s will make the first troop reconnaissance. They will also be the first elements to cross rivers. In some units PT-76s may continue in these missions.

The PT-76 is now leaving service, being replaced by main battle tanks (usually T-72s) in divisional reconnaissance units and BRMs in regimental units.

Soviet, East German and Polish amphibious units also use PT-76s. They swim ashore from landing ships 3,000m off the beach, firing on the way in if possible. Once ashore they support the BTR-60PBs or MT-LBs of the Naval Infantry in the same way that main battle tanks support the battalions of a motorised rifle regiment.

Late-production PT-76s swimming. They do not have snorkels extended – standard PT-76 swimming procedure – and their guns are locked directly forward. Each carries two unusual large fuel drums and a periscopic sight to enable the commander to see over the spray. The Soviet Navy had 130 PT-76s in 1986. *(US Army)*

Engagement sequence and countermeasures

The PT-76 engages a target in much the same manner as any other Soviet tank, and it is vulnerable to the same countermeasures. In addition, 0.50-calibre machine guns and 20mm cannon can penetrate its thin armour.

RKhM chemical reconnaissance vehicle

Weight 15 tonnes **Length** 7.3m **Width** 3.04m **Height** 2.2m **Crew** 6 (including dismounted scout team) **Ground pressure** 0.46kg/cm² **Max speed (land)** 60km/h **Max speed (water)** 5km/h **Max range** 500km **Engine** YaMZ-238V diesel, 240hp **Fuel** 550lit **Armour (hull)** 7mm

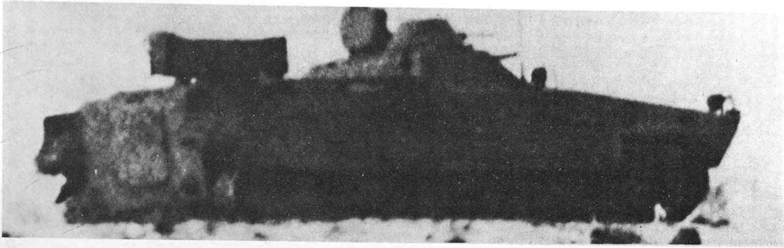
Using the same chassis as the 2S1 SP 122mm howitzer, the RKhM is probably replacing the BRDM-2RKh in tank and BMP regiments and possibly at division level as well. Identifiable by its raised superstructure with a cupola-mounted 7.62mm machine gun and rear-mounted warning flag dispensers, the RKhM mounts a variety of sensors which are presumably more advanced than those of the BRDM-2RKh.

Weapons effectiveness and combat usage

RKhMs were deployed to Chernobyl after the 1986 nuclear accident. It is not known whether any have been exported; the Warsaw Pact nations are the only potential recipients.

Tactical employment

Like the BRDM-2RKh, the RKhM will probably be integral to the Soviet reconnaissance effort. Individual vehicles will be part of forward patrols, determining which routes are safe from contamination. Other vehicles will be kept on the Soviet side of the lines to help find suitable areas for engineer work, artillery positions, command posts, or anything else requiring a contamination-free environment.



An RKhM, with the flag-planting equipment visible on the rear decking. *(US Army)*

Remotely piloted vehicles (RPVs)

The Soviets are known to have introduced a range of RPV reconnaissance systems. At least two types have been exported to Syria and used for missions over Lebanon.

DR-3 "Mini-RPV" in the same category (40kg) as the Israeli-designed Mastiff. Equipped with fixed-lens non-stabilised TV camera.

UR-1 Air-launched, high-altitude RPV. Can apparently be equipped for ECM, ELINT or TV reconnaissance.

DR-4, DR-5 Van-mounted, in current service.

It is uncertain whether these RPVs are under Army or Air Force control. Converted aircraft and cruise missiles have also been used as Air Force RPVs.

Foreign use

The BTR-40 has been in service with the Warsaw Pact armies, Afghanistan, Albania, Algeria, Angola, China (built as the Type 55), Cuba, Egypt, Ethiopia, Guinea, Indonesia, Iran, Israeli Border Police, Libya, Mali, North Yemen, Somalia, Sudan, Syria, Tanzania, Yugoslavia and a number of insurgent groups.

BRDM scout cars have seen service with the Warsaw Pact armies, Afghanistan, Algeria (50 -1, 50 -2), Angola (-1, 175 -2), Benin (12 -2), Central African Republic (12 -1, 22 -2), Congo (10 -1, 15 -2), Cuba, Djibouti (15 -2), Egypt, Ethiopia (200 -2), Guinea (25 -2), Guinea-Bissau (20 -2), Iraq, Israel, North Korea, North Yemen, Libya (250 -2), Madagascar (30 -2), Mali (-2 only), Mozambique (100), Nicaragua (39), Somalia, Sudan, Syria, Uganda (-1 only), Yugoslavia (-2 only), Zambia (-1, 50 -2).

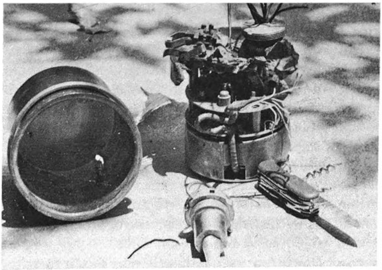
Sagger-armed BRDMs are in service with the Warsaw Pact armies, Algeria, Egypt, Iraq, Libya and Syria. Other countries that use both BRDMs and Saggers probably have these vehicles as well. Spandrel and Spigot-armed BRDMs serve with the East German, Czech and Polish armies.

PT-76s have been supplied to the Warsaw Pact nations, Afghanistan, China, Congo, Cuba, Egypt, Finland, Guinea (50), Guinea-Bissau (20), Hungary, India, Indonesia, Iraq, Israel, Jordan, Laos, North Korea, Mali (used in 1985–86 fighting with Burkina Faso), Mongolia, Mozambique (42), Nicaragua (28), North Vietnam, Pakistan, South Africa, Syria, Yugoslavia and Zambia.

The US Army has seven PT-76s and at least one Sagger-armed BRDM-2.

BRMs probably serve only with East Germany.

ACRVs probably serve with those Warsaw Pact armies using Soviet SP howitzers.



This sensor unit, a "reconnaissance-strike complex" captured in Afghanistan, can detonate a number of directional fragmentation mines. *(Mohammed Es 'Haq)*

Chapter Fifteen

Airborne, air assault and special operations forces

"Our airborne troops have been provided with the most up-to-date combat equipment and are capable of tackling a wide variety of complex missions."

GENERAL OF THE ARMY V.F. MARGELOV
(FORMER COMMANDER OF AIRBORNE FORCES)

Airborne forces were a Soviet creation, but the men who conceived the idea in the 1930s perished in the purges. Soviet airborne assault operations in the Second World War were mostly small in scale, haphazard in execution and almost invariably disastrous in outcome. However, the Soviet Union today musters the world's largest jump-trained force – seven Guards airborne divisions, at least one independent Guards airborne regiment, 11 air assault and four airmobile brigades, about 30 independent air assault battalions, plus four regiments, 16–24 brigades and over 40 companies of special operations forces all wear the blue beret and striped sailor's shirt of the paratroopers – though the Soviet Air Force can transport only two divisions at once. In the 1970s, however, the Soviets developed the ability to "surge" three division equivalents at shorter range. The subsequent expansion of the helicopter force and the forming of independent air assault and airmobile brigades and battalions has freed the divisions to concentrate on operational and operational-strategic missions. The war in Afghanistan, for instance, has seen a heavy commitment of airborne forces.

Its full range of airborne-capable units gives the Soviet Army the ability to carry out vertical envelopment, by parachute or helicopter, in the depths of NATO's defences. In this respect, airborne-capable units complement operational manoeuvre groups.

Soviet airborne operations

Soviet airborne operations can be operational-strategic, operational or tactical in scope and objective. The distinctions between the three are often uncertain. Operational-strategic operations use airborne divisions as the long arm of Soviet power, projecting them great distances to establish a new theatre of operations or to seize bases of strategic importance. In wartime such missions would be ordered by the Supreme High Command and carried out under the control of the General Staff. They have not yet been used in any postwar operation, though during the 1973 Middle East war at least part of the 103rd Guards Airborne Division was reportedly flown to a camp outside Belgrade Airport, where it remained poised to intervene if required. Other airborne divisions went on the alert in the Soviet Union. The increased importance that the Soviets attach to the potential for conflicts outside the Eurasian land mass in recent years has led to a corresponding increase in the importance of the airborne divisions. Their value as a rapid-reaction, strategic force is shown by the fact that all airborne divisions (except possibly the division at Tula-Ryazan, which has a training role) are kept at Category I readiness in peacetime. The division in the Baltic Military District may also have a training role. They are under the direct command of the Ministry of Defence, and so are highly responsive to the national command authorities. In wartime, however, airborne divisions will be assigned to theatres of operations or fronts.

The usual employment of Soviet airborne units will be on operational missions. Operational airborne assaults are similar to Operation Market Garden (the Arnhem landings) in the Second World War. Regiments, and possibly division-sized units, will drop up to 300km behind the front lines to take key objectives – airfields, bridges, logistics centres, weapons storage, nuclear weapons and delivery systems, headquarters, transportation centres, key terrain features – and "hold until relieved", which may take up to a week or, optimistically, two or three days. The Soviets employed a two-division force in this way in Exercise Dnieper in 1967, although more recent exercises

Soviet paratroopers in action, showing the characteristic camouflage suit, blue beret and striped sailor's jumper. They are using the AKD 5.45mm assault rifle. (*V.M. Martinova*)

have seen the use of regimental-sized airborne forces.

The most important operational mission is the *desant*, or insertion of forces in the enemy rear or flank. *Desants* can be transported by any means, but they will most frequently be heliborne or air-dropped. Such missions will involve units as large as a regiment or as small as a sabotage squad, dropped beyond the Soviet main forces to destroy nuclear-capable weapons and installations, attack headquarters and lines of communication, spread confusion and demoralisation, gather reconnaissance information in co-operation with long-range patrols and, along with forward detachments, seize routes for the Soviet advance.

Operational airborne assaults and *desants* are not intended to operate independently of the main ground forces. The Soviets realise that their airborne units are too small to do that. But they have the capability to cause great disruption in NATO rear areas. There are so many vulnerable areas that it would be necessary to divert troops away from the main battle to serve them. The actions of the 103rd Guards Airborne Division in seizing Prague Airport in 1968 and the 105th Guards Airborne in securing much of Kabul in 1979 are examples of the operational use of airborne divisions in conjunction with a larger force.

The increasing importance of the operational level in Soviet thinking on a future war in Europe has led to a growing emphasis on *desants*. What happened at Prague or Kabul could be attempted at Brussels or London. In the Zapad-81 exercises, airborne units were used extensively in support of a mobile group that was functioning in much the same way as an OMG.

Tactical airborne operations are normally carried out in conjunction with land attacks. They never occur more than 100km in advance of the front, and the units that drop are seldom bigger than battalion size, intended to hold a position for up to 48hr until the tanks arrive. Such air drops will be used especially in support of break-through attacks, river crossings and amphibious invasions, sealing off the battlefield from enemy reinforcements and blocking retreat routes. Heliborne troops, usually drawn from air assault or motorised rifle units, have largely supplanted the paratroopers in tactical air assaults. Jump-trained Naval Infantry units can be used in a similar way, in conjunction with amphibious operations.

Tactical *desants* were carried out by the Egyptian commando battalions on the first day of the 1973 War. Although none were air-dropped, some were inserted by helicopter deep inside Israeli positions, while most moved past suppressed Israeli strongpoints and created an anti-armour screen to prevent their relief and to cover the infantry moving across the Canal. The deep-penetration groups had some successes: one Israeli battalion lost several tanks in an ambush while still on their transporter trucks. The advancing Egyptians soon linked up with most of the *desants* and used them to reinforce their own defences. But other groups were never relieved, and helicopters attempting to insert more *desants* on the second day of the war were virtually wiped out by Israeli aircraft – all hazards inherent in the *desant* concept. Helicopter-inserted forces – usually of battalion strength, though sometimes less – have been a crucial element of Soviet tactics in Afghanistan, operating either independently or in conjunction with a combined-arms offensive.

Operationally and tactically, the importance of airborne forces increases in a nuclear conflict. The airborne unit's BMDs and 2S9s can move quickly through contaminated

contaminated areas and, combined with the BMD's airdrop capability, they can take advantage of any gaps in enemy positions created by nuclear weapons. The high rates of advance the Soviets envisage in nuclear war would allow link-ups with units dropped far behind the lines. Small *desants* would also be highly effective on the dispersed nuclear battlefield.

The future

Since the late 1970s the Soviet airborne forces have undergone substantial changes. The BMD, which had been limited to one or two regiments per division, now equips the whole force. Soviet airlift capacity has increased, with new heavy-lift aircraft, including the An-124 Condor, supporting strategic deployments.

Air assault and airmobile units are now able to take on many of the operational and tactical missions that in the past would have fallen to Guards airborne divisions. *Spetsnaz* can work in co-operation with the airborne, as was demonstrated in Kabul in 1979 and Prague in 1968. The training of one motorised rifle battalion in each motorised rifle division and separate brigade for heliborne operations, together with the provision of divisional helicopter squadrons, gives tactical commanders the ability to use vertical envelopment. Reports of division-level brigades may indicate further expansion.

This increase in capabilities largely results from the growing emphasis on conventional operations, especially those in depth. Along with the OMGs, heavy artillery and attack aircraft, heliborne forces are a vital element of the deep battle, which the Soviets see as the key to conventional victory in Europe. All these elements work in conjunction: in exercise Zapad-81, for example, one heliborne assault seized a river crossing for an OMG-like force, while another diversionary assault drew away reserves. The increased emphasis on surprise in the opening period of a conflict has also contributed to the new pre-eminence of the airborne forces. Again, Kabul 1979 and Prague 1968 both demonstrated the value of airborne forces for the forestalling of organised resistance.

Air movement is generally essential to a rapid and decisive response to contingencies outside Europe's central front. Airborne forces give the Soviets the ability to act in South Asia, for instance, before outside reinforcements arrive.

The Afghanistan War has absorbed a large percentage of the airborne forces. It is possible that the late 1980s and early 1990s will see new airborne divisions being organised to take the place of those formerly at Vitebsk and Fergana. Barring a full-scale withdrawal from Afghanistan, the 103rd Guards Airborne is likely to remain in-country.

The BMD series is likely to remain in service over the near future, along with increasing numbers of 2S9s. Other new equipment is likely to be standard Soviet Army issue.

Soviet airborne tactics

The Soviets believe that a purely airborne attack cannot succeed against an alerted enemy without either intense preparatory fires or high losses. Air drops will be made where enemy defences are weak or have been neutralised by air strikes, artillery or NBC weapons, and where enemy air defences cannot inflict losses on transport aircraft.

An initial air drop could rely purely on surprise, but the Soviets would have to secure air superiority for the widespread use and resupply of airborne units, especially those of regiment or division size. Resupply will be difficult at any time, owing to the shortage of transport aircraft.

Air drops are normally made at night. The transport aircraft will approach the drop zones along routes clear of enemy air-defence forces, and will be escorted by fighters. Drop zones can be on the objective or 5,000m+ from it. The zones – four to six for a division, one or two for a regiment – are marked by pathfinders from the divisional reconnaissance company, who are trained in precision jumping and have steerable canopies. They use visual and electronic beacons to guide the transports. Pathfinders may also be dropped on dummy zones as a diversion. 15min or more before the main drop, a company-sized advance assault reconnaissance group may secure each regimental drop zone, setting up outposts and a defensive perimeter. The first wave drops with all its heavy equipment and secures the zone for subsequent waves and resupply. Drops will usually be from 150-300m altitude, although 100m or less has been demonstrated. The Soviets emphasise the speed with which units can form up and advance after dropping: 30min for divisions, half that for smaller forces.

In division or regiment-sized operations an airhead for An-12 transport aircraft will also be secured as soon as possible. The paratroopers start with patrols from the drop zones, following these with rapid attacks, possibly supported by pre-arranged air strikes or artillery fires, though they will have to rely largely on their own weapons.

The weapons the paratroopers can bring to bear are powerful, and Soviet airborne units are heavily mechanised. While other paratroopers must march when they land, the Soviets will also drop BMDs, ASU-57s and light trucks. Their degree of mechanisation depends on airlift capacity. In the 1970s the Soviets produced enough BMDs to completely mechanise the Guards airborne divisions, giving each squad a BMD in the way that each motorised rifle squad has a BMP or BTR. While the 105th Guards Airborne Division took its BMDs when it was airlifted into Afghanistan, this might not be possible if more divisions were involved, ranges were longer or the division had to air-drop. But while this would create a formidable force, especially in an NBC environment, it would be a tremendous burden on the already stretched Soviet airlift capability. The number of BMDs in Soviet airborne units can apparently be adjusted to suit the type

of mission and airlift capability available. The introduction of the BMD has definitely increased the power of the Soviet paratroopers.

Soviet airborne units will defend against enemy counterattacks with the standard strongpoints and interlocking fields of fire. Their AFVs will be used as self-propelled anti-tank weapons, although all except the BMD's ATGMs lack stopping power against modern tanks.

While the BMD gives the airborne a significant anti-tank capability, it cannot prevail against heavy mechanised units. And without their BMDs, Soviet paratroopers are vulnerable even to smaller tank forces. In the attack some BMDs and ASU-85s may fire from overwatch positions. The BMD's ATGMs will be used against tanks or, secondarily, bunkers. The Soviets realise that the BMD is not a tank, and BMD units will try to use mass and surprise against enemy tanks. In the defence, concealment and camouflage, often in conjunction with ambush tactics, are stressed; BMDs will defend from defilade whenever possible, with the squad deployed 50-100m forward. Defending airborne divisions or regiments may use 2S9 or ASU-85 battalions or batteries in their anti-tank reserve.

Airborne units are not intended to fight long or intense battles. They have too few men and heavy weapons. The Soviets will airlift motorised rifle regiments and battalions as follow-on echelons to airborne forces once an airhead has been secured. This was seen both in Exercise Dvina in 1970 and in Kabul in 1979. Airborne units are expendable – as is any Soviet unit – if the objective is of sufficient priority. The airborne will infiltrate and bypass enemy positions and only when this is impractical will they attack.

The assault is similar to that of a motorised rifle unit, although artillery support will be less and the attacking troops will ride in or on 2S9s, ASU-85s or BMDs to a dismounting point, probably further away from the enemy position than in a motorised rifle unit's attack. The airborne armoured vehicles will then lead the attack, although the Soviets are aware that they are not tanks and cannot be successfully used as such. They do however give mobility, which the Soviets consider important in the sort of missions to which the airborne will be assigned. Airborne battalions may form forward detachments. Their march formation is similar to that of a motorised rifle battalion, with ASUs forward. If the enemy is encountered the ASUs will engage with direct fire to screen the battalion's deployment. Trucks, both dropped and captured, can supplement the BMDs. 2S9s may replace ASUs.

Soviet airborne forces receive high priority in manpower. All of their personnel have complete pre-induction military training, a distinction shared only by the Strategic Rocket Forces, which shows the strategic importance the Soviets attach to the airborne forces. Half of the airborne inductees undergo pre-induction parachute training.

A BMD-1, its suspension lowered, is removed from its pallet after airdropping.

They also realise that it is difficult to make a man both a soldier and a paratrooper in two years and, because the airborne divisions must be kept ready, they cannot afford to have 25% of their strength as raw recruits. Once a Soviet paratrooper is jump-trained at Tula-Ryazan he must make at least ten jumps a year to remain qualified. Officers that have graduated from the Ryazan Higher Airborne Command School will normally spend their entire service careers with airborne units. The "airborne mystique", the strong pride and cohesion of airborne units worldwide, seems to exist in the Soviet Army as well. The men in the blue berets are an elite, and they know it.

Airborne forces and the war in Afghanistan

The invasion of Afghanistan in December 1979 was one of the most effective uses of Soviet airborne forces in their history, and the airborne have been closely linked with the war ever since. The invasion itself demonstrated the operational-level mission of the airborne and how effectively it can be performed.

The invasion of Afghanistan may have come as a surprise to the West, but not so the manner in which it was accomplished. Based on experience gained in the invasion of Czechoslovakia in 1968, the 1979 invasion plan exploited the ability of *Spetsnaz* forces – tasked with the same mission as Guards airborne units – to stage a no-warning attack on high-value targets. The expanded Soviet military and civilian presence in Afghanistan before

the paratroopers started to fly in gave cover for the deployment of *Spetsnaz* inside the country.

The airborne began to enter Afghanistan weeks before the invasion, an airborne task force having been formed under high-level control, possibly the General Staff. It consisted of one regiment each from the 103rd and 104th Guards airborne divisions, and the entire 105th Guards Airborne Division. In the first two weeks of December 1979 the Soviets began transferring about 1,500 additional personnel into Afghanistan. A regiment of the 103rd Guards Airborne flew in to garrison at Bagram airbase on December 7-9. A second regiment, from the 104th, arrived on December 21-22, allowing the first to move to Kabul International Airport and reinforce a forward detachment which had secured the strategic Salang Pass tunnel on December 10.

On December 24 the paratroopers left their garrison and seized control of Bagram, 19km outside Kabul. Soon afterwards, the first of 280 sorties by Soviet Air Force and Aeroflot transport aircraft – An-12s, An-22s and Il-76s – began lifting in the main elements of the 105th Guards Airborne Division from its base in Fergana in the Turkestan Military District. These troops were fully mechanised with BMDs and they took over prepositioned fuel and trucks. They left their positions around Kabul and Bagram airports on the evening of December 26. As the motorised rifle divisions crossed the border on December 26-27, linking up with *Spetsnaz* forces and Soviet advisers and agents in place, the airborne moved out and seized chokepoints, command, control and communications facilities, and Afghan Government headquarters. The presidential palace – defended by Afghan troops with eight T-54s – is reported to have required a two-battalion assault by BMD-mounted paratroopers. The paratroopers held their objectives until relieved by motorised rifle divisions moving south from the Soviet Union.

Since 1979 the same airborne units have served in Kabul as a "palace guard" for the Soviet viceregal court, and possibly as a power-projection force for South Asia and Gulf contingencies.

In the first year of the war the airborne forces did not see much action. At around this time the 105th Guards Airborne Division was disbanded, one regiment being retained as an independent unit. The 103rd remained the one Guards airborne division in Afghanistan.

In 1981 the new emphasis on smaller, airmobile operations led to a greater use of airborne forces. The following year the airborne frequently found themselves operating in conjunction with larger, combined-arms ground offensives. The commitment of paratroopers to battle did not however always lead to success. In the 1984 Panjshir VII offensive, no fewer than four airborne regiments (two from the 103rd, one from the 104th, one independent ex-105th) were used, but the operation yielded little more than its predecessors. In this offensive, as in Panjshir V two years before, a battalion-sized helicopter-inserted force, presumably composed of paratroopers, was badly cut up by the Afghans.

The 1983 shift in emphasis to small units using special-operations tactics, either independently or in conjunction with combined-arms forces, meant more action for the airborne. This had much to do with the quality of airborne manpower. While, until 1984 or later, the Soviets would send out untrained each new intake of replacements for the divisions in Afghanistan, much as they do for Group of Soviet Forces Germany, the personnel in the Guards airborne units are all well prepared before going. This made them prime candidates for specialised infantry missions requiring night, mountain or counter-insurgency skills. The Soviet airborne forces have emphasised mountain operations since before the Afghanistan war: of 18 airborne-related articles appearing in *Military Herald* in the three years before the war, six dealt with the seizing of mountain passes.

At least one air assault brigade and probably an independent air assault battalion are part of the Limited Contingent of Soviet Forces in Afghanistan. Other air assault units may have rotated in from the Soviet Union for specific operations.

These forces carry much of the burden of offensive counter-insurgency operations in Afghanistan: independent patrolling and night ambushes, and convoy protection and major offensives in conjunction with combined-arms forces. The extent of the role played by airborne, air assault and special operations forces in Afghanistan is indicated by the fact that of the 50 Hero of the Soviet Union awards earned in the war by 1987, half had gone to members of these formations.

Airmobile and air assault brigades and battalions

Air assault and airmobile brigades are apparently intended for operational-level action, the air assault battalions for tactical action. The brigades are significant in that they give operational commands at front or TVD level a striking force with a 20-100km reach while relieving them of the need to draw on units of the Guards airborne divisions that in peacetime are directly under the Ministry of Defence and in wartime may be withheld for operational-strategic missions.

The deployment of these brigades and battalions results from the recent upsurge of interest in "the keys that unlock the stability of the enemy defence" – forward detachments, airborne *desant*, and "raiding" forces – especially in the context of the operation in depth or the deep battle. In addition, these new units have the mobility and striking power needed for action in conjunction with operational manoeuvre groups.

A BMD-1 is unloaded from a Mi-26 Halo. This heavy-lift helicopter is designed to insert and resupply Soviet airmobile and air assault units.

The air assault and airmobile brigades give the Soviets additional capabilities for an invasion of Europe, Iran or other potential targets. They can be used to seize mountain passes, airfields, road junctions, chokepoints, command and government centres, and other key objectives in conjunction with airborne forces. Heliborne forces reduce the necessity for the seizure of a major airfield at the start of the operation. Soviet tactical writings stress that it is better to have a company at a crucial point before the enemy can react than to have a division there afterwards. Thus the use of helicopter and parachute-inserted forces to help secure river crossings has been a feature of large-scale exercises since the 1960s. Enemy command posts and support activities have also been the targets of such air-inserted attacks. Despite the risk of heavy losses, follow-up echelons have been inserted directly into the forward area by An-12 Cubs, often using roads as airstrips.

The airmobile brigades, first organised in the early 1970s, have Frontal Aviation helicopters under the command of brigade headquarters. This represents a degree of integration between helicopter and ground forces that had not been seen previously in the Soviet Army. Like its US counterparts, the Soviet airmobile brigade needs two missions to lift itself with its own resources. While the helicopters remain the property of the Soviet Air Force, and their crews are Air Force personnel, they are under the operational command of brigade headquarters.

In the mid-1980s airmobile brigades were reported to be deployed at Kutaisi in the Transcaucasus Military District, Mogocha in the Transbaikal Military District, and Magdagachi in the Far East Military District. Another is said to be deployed in the Turkestan (or possibly the Central Asian) Military District.

The air assault brigades (designated DShB, *Desantnii Shturmovaia Brigada*) were formed after the airmobile brigades – probably in the late 1970s and early 1980s – and are heavier units. (The Soviets apparently apply the DShB designation to both types of brigade; the distinction is a Western one.) The air assault brigades lack organic helicopters, depending instead on rotary or fixed-wing transport allocated from army or front level. At present 11 air assault brigades, including the one in Afghanistan, are reported to exist. The brigade at Vitebsk in the Leningrad Military District is reported to be trained for operations in Scandinavia. Other brigades are deployed in Group of Soviet Forces Germany, Southern Group of Forces in Hungary, and the Baltic, Byelorussian, Carpathian, Odessa, Central Asia and Far East military districts.

Also dating from the 1970s are the independent air assault battalions, made up of airborne-qualified personnel and lacking organic lift capability. Army-level headquarters may have one, possibly more, of these battalions for operations up to 30km behind the FEBA. They offer a tactical airborne or air assault capability for use in the type of mission that previously would have required the detachment of a motorised rifle battalion from one of the army's divisions.

The fourth infantry battalion in each Naval Infantry brigade – added when these formations were upgraded from regiments in about 1980 – is believed to be similar to the air assault battalions in organisation. It can be inserted by parachute, helicopter or hovercraft to secure beachheads for the remainder of the brigade, and may be capable of using BMDs.

The personnel of the air assault and airmobile brigades and battalions are reported to be part of the VDV (*Vozdushno-Desantnyye Voyska*, Airborne Forces). They are all jump-trained and wear the distinguishing blue beret and striped undershirt of the airborne.

In high-readiness areas such as East Germany and Afghanistan, and possibly elsewhere, one motorised rifle battalion in each motorised rifle division or separate brigade is also trained in heliborne operations. This is an extension of previous practice, under which one company per regiment was so trained. A large proportion of the heliborne operations in Afghanistan are probably carried out by these battalions.

The mix of battalions in the air assault brigades – one or two "heavy" battalions equipped with BMDs and two or three "light" battalions that move dismounted or in captured and air-dropped trucks – results in a wide range of capabilities. The BMD-equipped battalions could be air-landed – by either fixed-wing transports or helicopters – into positions seized by the "light" battalions, which could be inserted by helicopter or parachute.

The helicopter is the primary transport for the airmobile brigades. While the air assault brigades are more oriented towards standard air drops – as evidenced by the provision of a parachute rigging company, which the airmobile brigade lacks – it appears likely that they would also use helicopters when the situation permitted. The need for helilift of more heavy equipment, especially BMDs, may be answered by increased deployment of the Mi-26 Halo.

The ability of Soviet attack helicopters to suppress defences and provide air support for helicopter-inserted forces has been demonstrated both in Afghanistan and in recent exercises such as Zapad-81. As a result, such forces may come to rely principally on the helicopter for both transportation and firepower, as is already the case with operational manoeuvre groups.

The 56th Air Assault Brigade has been deployed in Afghanistan since 1980 and has seen extensive combat. It moves primarily by helicopter, although the Afghan Resistance reports that large numbers of BTR-series vehicles are also used for ground operations. A number of independent air assault battalions are also in Afghanistan. Other heliborne units have been committed to battle directly from the Soviet Union, sometimes for extended operations.

The disbandment of the 105th Guards Airborne Division in Afghanistan means that the airborne is the only type of division actually to have decreased in numbers in the 1980s. This may indicate that the airmobile and air assault brigades are taking over some of the roles previously filled by the airborne divisions. It also suggests a shortage of airborne-trained conscripts to meet the needs of both the new brigades and the existing Guards airborne divisions.

Soviet special forces

Soviet special forces (*spetsialnoye naznachenie*, "special purpose", otherwise known as *Spetsnaz*) serve not only with the Army and Navy but also with the KGB and GRU, both of which have their own *Spetsnaz* forces. *Spetsnaz* formations are operationally equivalent to Western special operations forces.

These forces are tasked with what the Soviets term "special reconnaissance", so described not only because of the depth at which it can take place but also because it combines information-gathering with "influence" – destruction, capture, confusion – upon the target. Nor does it have to wait for hostilities to break out, being used to determine the intentions of potential enemies, to discover the location and status of high-value targets, and to influence such targets as necessary. Operations often include the acquisition, capture or destruction of equipment, personnel and documents; deception (*maskirovka*);

Razvedchiki run an obstacle course. Special operations forces have higher physical standards than the rest of the army. Despite training hard, the Soviet soldier does not receive the intense physical conditioning of his Anglo-American counterpart. Reservists are frequently criticised as being "soft".

area reconnaissance, including signals intelligence (SIGINT); and point reconnaissance.

All levels of Soviet Army command, from regiment up to the General Staff, have their own reconnaissance assets. The ground combat units used for reconnaissance in the operational or strategic depths of the enemy defence must have capabilities above and beyond those needed for purely tactical missions. The Soviets have given such forces a key role ever since, in 1918, the "special purpose cavalry" in the Red Army was constituted to report to intelligence officers at front, army, corps and sometimes division levels.

Reconnaissance in the depths of the enemy positions, or even in his homeland, requires cover. This can be provided by the full range of *maskirovka*, including skilful use of terrain, weather and deception measures. In 1920, Soviet cavalry forces in Polish uniform are said to have been employed behind the Polish lines. In recent times, it is believed that Soviet-bloc long-distance truck drivers and other visitors to Western Europe are engaged in peacetime reconnaissance under the cover of civilian status. While the Soviets rely mainly on their Warsaw Pact allies for this activity, the ability to insert forces in NATO uniforms into Western Europe remains an important element of their special operations.

In addition to the longer-term goal of spreading *dezinformatsiya* ("disinformation") in an effort to neutralise potential opposition, discredit allies, and suggest community of interest with the USSR, *Spetsnaz* operations can also seek to undermine national resistance through political measures. This is a means of striking directly at the enemy's strategic war-fighting capability, and is an example of the strategic mission of Soviet special forces.

Operational missions include striking at high-value targets, in support of an invasion, as in Prague in 1968 or Kabul in 1979. In both cases *Spetsnaz* were instrumental in the subsequent success: backed up by the Guards airborne divisions, they seized key objectives in the two capitals helping to snuff out organised resistance before it could gather momentum. They would try to do the same in Brussels, Bonn or London, linking up with "sleepers" and other in-place assets. *Spetsnaz* tactical missions require them to act as specialised counter-insurgency light infantry in Afghanistan and as general commando/special forces units elsewhere. Most armies engaged in counter-insurgency campaigns have found that line infantry units are usually incapable of the type of offensive action required, and have fielded specialised light infantry instead. Soviet special operations forces have assumed part of this role.

Their ability to strike directly at the enemy's ability to fight a war rather than at his armed forces makes *Spetsnaz* important to the highest levels of the Soviet command structure. As a result, the relationship between the special operations forces and the Party is strong. This linkage was evident in the Party's support of partisan forces in the Second World War and in the present subordination of some *Spetsnaz* forces to the KGB. During the Second World War troops of the KGB's predecessor, the NKVD, were inserted by air to train and lead partisan groups, being designated *Osnaz* (*Voiska Osnoga Naznacheniya*, "special purpose troops"). It has been suggested that the *Osnaz* designation is retained by special operations forces – such as those of the MVD and KGB Border Troops – tasked primarily with operations on Soviet territory. Today the partisan training mission is shared by the KGB and Army *Spetsnaz*.

To provide for the effective employment of special operations forces at all levels of conflict, staffs for the direction of *Spetsnaz* and partisan operation exist at the *Stavka*, TVD high command and front levels.

Spetsnaz forces at front or fleet level consist of an agent network subordinate to the Third Department of the Second Directorate within each front or fleet. The network is said to be composed of fully trained GRU personnel and agents who can pass as natives in their target countries. It is separate from that of the Second Department in the same Directorate and is usually deployed to the target country before the outbreak of hostilities. The network recruits agents; conducts reconnaissance and target surveillance; provides reception committees, guides, transport, false documentation and logistics for incoming *Spetsnaz* groups; and engages in limited sabotage.

The *Spetsnaz* agent networks are distinct from, but use information obtained by, the more familiar peacetime GRU and KGB intelligence-gathering networks. The *Spetsnaz* in-country agent networks are by definition composed wholly of "sleepers" who are activated only in peacetime or upon the arrival of *Spetsnaz* teams.

Spetsnaz would play a central role in any future conflict in Europe. If it were decided to try to win the war by conventional means alone, an initial nuclear strike to neutralise enemy nuclear delivery systems and stockpiles, targeting means, headquarters, communications centres and bridges would be ruled out. Instead, the Soviets would rely on special warfare forces and conventional long-range systems for the destruction of such targets. *Spetsnaz*, air, artillery, paratroopers and surface-to-surface missiles would all work to the same detailed target list, with each target to be hit by a variety of means. Effective, secure communications would be needed to tie all this together.

Because of their importance in the critical opening stages of the war – particularly in regard to their ability to pre-empt retaliation if not resistance – Soviet special forces would be used with the utmost secrecy. This might actually rule out the use of some forces before H-Hour, since their inadvertent disclosure might have a far-reaching impact. The activities of the different *Spetsnaz* forces, agents, in-place networks, fifth columns and other assets would be closely planned and co-ordinated, and while they may be

divided tactically and administratively, unity of command would be apparent in their actual use. Resupply would come either from enemy stocks or from conventional Soviet forces following link-up.

Apart from penetration before outbreak of war, *Spetsnaz* can use a variety of insertion techniques. Parachute is one of the most important: as early as 1930, Soviet exercises included the airborne insertion of small diversionary detachments. Clandestine surface craft, such as trawlers and false-flag or neutral-flag merchantmen, and, especially for naval *Spetsnaz*, submarines can be used. The post-war Quebec-class submarine was specifically designed for the delivery of such detachments. Today, more modern boats perform the same missions. Other methods include ultralight aircraft and midget submarines. The Soviets appear to lack specialised helicopters and fixed-wing aircraft comparable with those that support US special operations forces.

Spetsnaz aims to create a "front in the enemy rear". If the enemy rear is in Soviet territory, this will include partisans. If not, the Soviets plan to use fifth columns. To supplement such forces during the Second World War, the Soviets directed 35-40-member airborne assault teams and smaller naval special operations detachments against strategic military and industrial targets, while partisans and diversionary units of up to regimental strength operated behind German lines. Special warfare troops were used to create and reinforce partisan groups after 1941, and to strike directly at German rear areas.

Partisan training was an important mission of the special operations forces at that time. Since then there have been repeated reports of special operations forces training foreign guerrillas and terrorists, both in the Soviet Union and elsewhere. While the composition and subordination of Soviet military advisory teams is uncertain, *Spetsnaz* officers would certainly possess skills useful to armies centred on light or counter-insurgency forces. The presence of *Spetsnaz* as part of advisory efforts, especially in less developed nations, is therefore likely.

Special operations forces can be used against insurgencies as well as to support them. They were heavily involved in the Soviet conquest of Central Asia in the 1920s and 1930s. After the war they were used extensively in the campaigns against anti-communist guerrillas in Poland, the Ukraine and the Baltic republics. Afghanistan has seen much activity by special operations forces in the counter-insurgency role.

Types of special operations forces

Reconnaissance Troops

Razvedchiki (scouts) are found in each Soviet division. One company of each divisional reconnaissance battalion is trained for long-range operations. The reconnaissance company in all Soviet divisions is subordinate to the divisional chief of reconnaissance and is responsible for tactical reconnaissance and limited sabotage operations 100km behind enemy lines. The reconnaissance companies of airborne divisions have greater special operations capabilities and can operate at longer ranges in the enemy rear. They are trained in a variety of airborne insertion techniques. Army-level headquarters also have a reconnaissance company that is jump-trained. Equivalent to the US Army's LRRP companies, the army-level units and other possible independent units may be considered *Spetsnaz*. Their training probably emphasises observation and signalling.

In an army or front, the reconnaissance companies may be centrally commanded by the chief of reconnaissance of the higher formation, rather than subordinate commanders. In Afghanistan a central chief of reconnaissance apparently tasks all reconnaissance assets.

Raydoviki

The "raiders" are apparently similar to US Ranger battalions and operate in company and battalion-sized forces. They are apparently all jump-trained, and appear to make up the bulk of front-level *Spetsnaz* brigades. They have heavier weapons than other *Spetsnaz*. They would train partisans behind enemy lines in wartime. *Raydoviki* seem particularly well suited to limited war. Their training probably stresses light infantry tactics and demolitions.

Soviet special operations troopers emplace a detonator. *Raydoviki* apparently receive demolition training and include "assault pioneer" detachments. In action in Afghanistan the combat suit hood is usually worn down, the better to hear the click of a Lee-Enfield bolt or a mine detonator. *(Steven Zaloga)*

Vysotniki

Resembling US Special Forces, these troops operate in small, mission-tailored teams, carrying out deep airborne sabotage, reconnaissance and intelligence penetrations behind enemy lines. They are trained in HALO (high-altitude, low-opening) parachute techniques and a broad range of special forces missions (but excluding partisan training). Because it is difficult to bring serving conscripts to the standard required by the *vysotniki*, it is thought that most of the personnel are officers, warrant officers or long-service NCOs.

KGB Spetsnaz

KGB *Spetsnaz* is believed to be a small but highly professional force, able to work with in-place KGB agents and support networks. Missions are thought to include high-level assassination and sabotage in the civil sector, and direct attack on key strategic targets such as command and communications facilities and headquarters. The KGB is probably primarily responsible for operations in the enemy's strategic depths.

It is likely that KGB *Spetsnaz*, possibly reinforced by airborne forces, carried out some of the more sensitive tasks in the 1968 Czech invasion, including the abduction of Dubcek.

KGB teams would penetrate target countries further in advance of a potential conflict than their GRU counterparts, concentrating at safe houses before starting operations.

The KGB Border Troops have their own special operations forces, tasked with support of their military operations. Border Troops are reported to have been in action in the 1980s, and these forces may have been involved.

MVD Internal Troops and Special Troops

The MVD Internal Troops have their own special operations forces. While primarily oriented towards internal security operations – possibly in the anti-riot or anti-dissident role – they have probably also been involved in combat in Afghanistan. MVD special forces are reported to have been involved in the 1968 invasion of Czechoslovakia.

Naval Spetsnaz

The Soviet Navy has a significant special forces capability. There are four naval *Spetsnaz* brigades, one for each fleet. Each brigade has a headquarters company of specialists (mainly officers, with communications, SIGINT, demolitions and other skills), two or three combat swimmer battalions that are also airborne-capable, a midget submarine unit (similar to the ones that have been operating off Sweden), and support elements. The fleet *Spetsnaz* brigade is believed to be smaller and capable of fielding fewer groups than its front counterpart. These brigades are reported to have been augmented by the mid-1980s.

The Soviets are developing mountain warfare forces for operations beyond the capabilities of normal motorised rifle units. They receive specialised equipment—including commercially purchased Western mountaineering kit—and uniforms. It is probable that motorised rifle, airborne and special operations forces units and sub-units have been retrained for this role. *(US Department of Defence)*

Mountain Troops

The Soviets have used the term "mountain troops" to describe certain units in current service, suggesting that they have at last recognised the need for such a specialisation. These are probably airborne, motorised rifle or *Spetsnaz* units that have been trained and equipped for mountain operations, which were not practised by the Soviet Army before the war in Afghanistan. At first motorised rifle units had mountain warfare as a secondary role. But experience soon revealed a deficiency in skills, with the result that these units now probably have mountain warfare as their primary speciality.

Desert Warfare Troops

There have been reports that the Soviets are building two training centres in Afghanistan, one near Shindand and

one near Farah, for newly created desert warfare units. The new units are possibly designed for a strike against the Gulf of Hormuz. This development would suggest a continuing emphasis on specialised training and capabilities not found in standard motorised rifle divisions. Desert warfare units could complement heliborne forces.

GRU Diversionary Troops
In addition to its intelligence agents, the GRU (Main Military Intelligence Directorate) has a number of "diversionary" battalions, a broad term which probably covers several types of unit. GRU Diversionary Troops are controlled by the intelligence directorate of the General Staff, and act in support of strategic, operational and tactical military and political projects. They would possibly attack key targets – political and military leaders, nuclear-related bases, headquarters, airfields, communication centres – with the aid of agents in place and sympathisers. GRU teams would move towards their objectives by sea, parachute or helicopter in the days before the outbreak of war.

GRU Diversionary Troops units include teams which can operate in civilian clothes or enemy uniforms. They would infiltrate objectives before hostilities commenced, and include teams trained to kill important individuals. GRU troops, both in uniform and in disguise, were apparently involved in the taking of Kabul in 1979. They are reported to be trained in a wide variety of intelligence and commando tasks and in the use of both Soviet and foreign weapons.

The differences between the various types of Soviet Army *Spetsnaz* are unconfirmed by Soviet open sources.

Training

Soviet training for airborne and reconnaissance troops covers unarmed combat, superior physical conditioning, parachute qualification and heliborne operations. It is likely that *Spetsnaz* forces are also strong in these areas. But while they are certainly tough and fit troops, they include many two-year conscripts (except in the *Vysotniki* and some of the GRU and KGB forces) and are thus unlikely to be all-round "super-soldiers" on the model of the British Special Air Service or the US Special Forces. Rather, their training is probably for one speciality; this contributes to the multiplicity of forces. Thus the *Razvedchik* may learn map-reading and communications, while his *Raydovik* brother learns demolitions.

Spetsnaz officers are reported to be trained at the "reconnaissance faculty" of the Kiev Higher Combined Arms School and the "special faculty" of the Ryazan Higher Airborne School. Senior staff officers are trained at the 3rd Faculty of the GRU academy. All are trained to a high level of physical fitness.

Organisation

Western sources report that there is a central *Spetsnaz* regiment and intelligence centre directly under GRU command. This Long-Range Reconnaissance Regiment (also known as the Sabotage Regiment) is believed to be stationed in Moscow. Its personnel are said to be mostly highly skilled professionals from the GRU Diversionary Troops, and it is believed that the regiment can field more than 100 mission-tailored groups.

It is also reported that there are three TVD-level long-range reconnaissance regiments, assigned respectively to the Western, Southwestern and Far Eastern TVDs. Their personnel and strength are similar to those of the Moscow-based regiment; their manpower may also be considered part of the Diversionary Troops.

On mobilisation it is likely that each front or fleet will have a *Spetsnaz brigada* (brigade) – subordinate to the Third Department of the Second Directorate (intelligence) of its headquarters staff – under the operational command of the chief of intelligence. A front *Spetsnaz* brigade is believed to consist of a headquarters company of 70-80 specialists (including *Vysotniki* teams). This company carries out missions similar to those of the headquarters companies of separate army *Spetsnaz* battalions. The brigade also has three or four *Raydoviki* battalions, each capable of deploying as many as 45 groups of various sizes, as well as acting as a single battalion force. *Raydoviki* battalions consist of three to six 40-50-man companies, each divided into six teams. The battalions also have one or two heavy companies with ATGMs, 82mm mortars and single-tube 122mm rocket launchers similar to those used by the guerrillas in Vietnam and Afghanistan, and specialised engineer, demolition and communications detachments. The brigade has various support elements, including parachute rigging, logistics, transportation and signals. Brigade full strength is believed to be 900-1,500 personnel.

While most Western sources believe that there are 16 of these brigades, deployed mainly in the Groups of Forces, border military districts and in Afghanistan (three or more), it has also been reported that the number had been increased to 24 by the mid-1980s.

In addition, it is probable that each front-level intelligence regiment has its own long-range reconnaissance company or battalion, which can also be considered *Spetsnaz*.

The separate army-level *Spetsnaz* battalion – unlikely to be present in every army – consists of a headquarters company, three companies of 5-15 groups each, and a signals company which possibly has a radioelectronic combat (REC) capability. The headquarters company is believed to be staffed by officers skilled in clandestine infiltration, martial arts and communications. They act as a cadre for sensitive missions and as clandestine agents, and

include *Vysotniki* among their number.

Army-level *Spetsnaz* companies may be different from army-level long-range reconnaissance companies. The former are believed to be associated with the intelligence battalion and are thought to comprise approximately 115 personnel, including about 20 commissioned officers and warrant officers. Each is organised into a headquarters, three "diversionary" platoons and a signals platoon. Able to field up to 15 groups 100-500km behind enemy lines, it is subordinate to the Third Group of the Second Department of the army staff.

According to Western reports, there are also independent *Spetsnaz* companies made up, like the army-level companies, of 115 men, including nine officers and 10 warrant officers. On sabotage operations they move in groups of 15 or more. Each company has a communications platoon which can operate over a range of 1,000km.

Equipment

Some *Spetsnaz* can use a wide variety of demolitions, including atomic munitions and, it is believed, chemical and biological weapons.

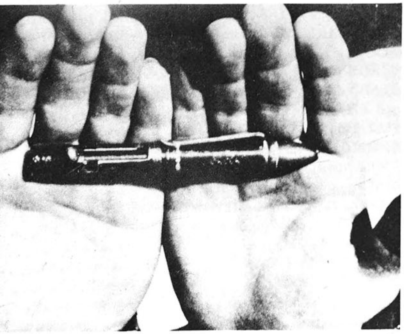
In Afghanistan they have used silenced AKMS rifles and P6 pistols, along with more conventional light infantry weapons: AK-74 and AKSU 5.45mm rifles, SVD 7.62mm sniper rifles, PKM 7.62mm general-purpose machine guns, RPG-7s, RPG-18s (used against Afghan supply vehicles and as anti-sniper weapons), BG-15 under-barrel 40mm grenade launchers mounted on Kalashnikovs, a larger than usual proportion of rifles with infra-red and telescopic sights, and AGS-17 30mm automatic grenade launchers. Another weapon known to be used by *Spetsnaz* in Afghanistan is a knife that projects a spring-loaded blade over a range of 15m. In a conventional war, man-portable SAM launchers would probably also be carried. The *Raydoviki* use heavier weapons and have motorcycles, UAZ-469 jeeps and GAZ-66 trucks for mobility.

Spetsnaz electronics include R-350M man-portable tactical radios capable of secure burst transmission, and man-portable radio direction-finding sets.

Laser rangefinders and designators are among the optics used for target acquisition.

A number of Soviet special forces units are known to be trained in impersonating NATO troops, wearing US, British, Danish and West German uniforms. But it is the East Germans who specialise in this field. They have at least one commando battalion at Lehnin, near Potsdam: the 5th "Willi Sanger" battalion. It is capable of being dropped behind NATO lines wearing West German uniforms. Another East German force, estimated at two companies, has M-48 tanks and M-113 APCs. These vehicles, obtained from Vietnam, are stationed in southern East Germany and are painted in West German markings. Other Warsaw Pact states also maintain special forces units, including the Czech 7th Airborne Battalion at Hoelleschau and several Polish units.

A Soviet explosive pen captured in Afghanistan. Although this example represents an old design used by partisans in the Second World War, it typifies the specialised sabotage equipment that would be employed by Soviet special operations forces. *(Committee for a Free Afghanistan)*



Afghanistan and special operations forces

Afghanistan has shown that Soviet special and unconventional warfare units, though comparatively small, have an importance far outweighing their numbers.

Spetsnaz played an important role in the 1979 invasion, seizing key communications facilities, government buildings, command centres and chokepoints. The Duralamin Palace was taken by two battalions of Guards airborne troops only after an attempt by *Spetsnaz* had failed. More vulnerable objectives were apparently taken by small detachments exploiting surprise. These detachments may have worn civilian clothes or DRA uniforms and carried concealed weapons. They acted in co-operation with Soviet advisers – who immobilised DRA military equipment and put key DRA personnel out of action – and agents already in place. As a result, the Soviets were not confronted with what they apparently feared most: organised mass resistance by the DRA armed forces.

This was an example of what the Soviets define as an "operational" mission for special operations forces. Since the invasion, *Spetsnaz* in Afghanistan have primarily carried out "tactical" missions.

There may have been a pause in the deployment of *Spetsnaz* to Afghanistan after the invasion. But then in 1981 the Afghans started to encounter Soviet troops that they considered to be *Spetsnaz*-type units, and it is likely that substantial *Spetsnaz* did indeed join the Limited Contingent that year; they were certainly in action throughout 1982. Special forces based in the Soviet Union have been deployed directly into action in Afghanistan, following the lead of airborne and air assault units.

Not all "special forces" missions in Afghanistan are carried out by *Spetsnaz*. Troops from airborne divisions and the independent regiment, the air assault brigade, the air assault battalion, KGB Border Guard mobile groups, and the motorised rifle battalions in each motorised rifle division and independent motorised rifle brigade that is trained in heliborne operations provide much of the manpower required for these operations. In any event, the dividing lines between *Spetsnaz* and the rest of the Soviet armed forces are less relevant in Afghanistan where the special forces are tasked with tactical battlefield missions, functioning as specialised counter-insurgency light infantry.

In 1984–86 there was an increase in special forces operations throughout Afghanistan. The fact that special-forces tactics have emerged as a major part of the war effort is consistent with the use of massive firepower, applied by large-scale ground offensives, bombing or helicopters, to depopulate areas of the countryside. Special operations forces are tasked with doing what massed firepower or massed mechanised forces cannot accomplish.

In their role as counter-insurgency light infantry, the special operations forces provide reconnaissance as well as fighting power. They are inserted, usually by helicopter but also by parachute, truck or on foot, in forces ranging from scout teams to full battalions. These can either operate independently or in conjunction with conventional Soviet or DRA forces. They block Resistance movement, seize high ground, and surround villages and other objectives. Helicopter mobility gives a capacity for manoeuvre and surprise that ground combined-arms columns lack.

The Soviet interdiction effort combines special operations forces with artillery, air power and irregular DRA forces. Special-forces patrols are frequently used to interdict supply routes and night movement, operating along infiltration routes. The Soviet units move both on foot and in vehicles, including BMDs lifted in by helicopter. Such forces conduct raids in Resistance territory that can last several days. Patrols operating along infiltration routes plant mines, especially at chokepoints such as river fords, and either set up an ambush or call in an air strike when they locate Afghan activity. The interdiction of enemy lines of supply, especially transportation, is always a priority.

Special operations forces have been operating in conjunction with DRA militia in eastern Afghanistan. Of all the forces the Soviets possess, these two are most suitable for independent dismounted operations: *Spetsnaz* because of their training, the militia because they are armed and equipped like the Resistance and are able to operate in the same manner. The Resistance fear militia patrols more than they do the unenthusiastic conscripts that make up most DRA units.

Some special operations forces have been used for convoy protection, probably establishing outposts on crests ahead of the column. These are often inserted by helicopter and then extracted after the convoy had passed. Other special operations forces have been assigned to airfield protection duties, following a number of Afghan attacks on Soviet bases, and are used for aggressive night-time patrolling and outpost duties to prevent further rocket and mortar attacks.

Some of the special operations forces in Afghanistan may have a primary mission of force projection outside Afghanistan, while the units in garrisons around Kabul have to safeguard the Soviet command structure.

Afghans say that *Spetsnaz* have operated in DRA Army uniforms and carry DRA-issue weapons. This practice permits surprise attacks on the guerrillas, who frequently conclude local non-aggression pacts with DRA forces. *Spetsnaz* are also reported to have operated dressed as guerrillas, and Soviet troopers dressed as shepherds have driven herds of sheep up to Afghan positions before attacking.

Unit organisations

Airborne division

Total strength: 6,500 personnel, 270 BMDs, 27 BMD-2 M-1979/1s, 33 BMD-2 M-1979/3s, 15 BRDM-2Us, 8 BRDM-2s, 31 ASU-85s, ASU-57s as required, 30 D-30s, 6 M-1975 MRLs, 18 120mm mortars, 183 SA-7/14/16s, 36 ZU-23s, 27 ATGM-armed BRDMs, 421 RPG-7V/16Vs, 54 AGS-17s, 301 RPKS-74s, 13 UAZ-69RKhs, 3 ARVs, 2 BTMs, 2 BAT-Ms, 149 UAZ-69/469s, 500 GAZ-66s, 300 ZIL-130/131s, 12 Ural-375Ds, 30 KrAZ-255Bs, 30 UAZ-452s, 24 signals vans, 60 ZIL maintenance vans, 3 SIGINT vans, 56 ZIL POL trucks.

One divisional HQ (76 officers, 122 men, 3 BMD M-1979/3s, 2 BRDM-2Us, 6 SA-7/14s, 16 jeeps, 6 GAZ-66s, 8 GAZ vans)

Three airborne regiments

One artillery regiment

One anti-aircraft battalion (155 personnel, 12 SA-7/14s, 18 ZU-23s, 1 jeep, 25 GAZ-66s. The ZU-23s are probably being replaced by SA-9 vehicles one for one)

One material support battalion (120 personnel, 10 jeeps,

60 GAZ-66s, 50 ZIL-130/131s, 12 KrAZ-255Bs)
One engineer battalion (28 officers, 344 men, one bridge set, 13 mine planters, two mine trailers, one-plus armoured recovery vehicles, 11 GAZ-69, 25 GAZ-66, three SA-7)
One signals battalion (22 officers, 221 men, 30 GAZ-69, three SA-7, 23 GAZ-66, 11 motorcycles)
One reconnaissance company (four officers, 76 men, can be issued with nine GAZ-69, nine BRDM, nine RPG-7D, nine motorcycles, nine SA-7)
One NBC defence company (eight officers, 90 enlisted men, nine GAZ-69, 19 GAZ-66, three SA-7)
One services and supply company (three officers, 40 enlisted men, six GAZ-66, three SA-7)
One maintenance battalion (eight officers, 108 enlisted men, nine GAZ-69, 11 GAZ-66, two armoured recovery vehicles, three SA-7)
One parachute rigging company (seven officers, 94 enlisted men, three SA-7)
One medical battalion (35 officers, 123 enlisted men)

Airborne artillery regiment
Total strength: 620 personnel, 21 SA-7/14, 54 GAZ-69, 72 GAZ-66, 4+ BMD ACRVs.
One HQ battery (five officers, 59 enlisted men, 12 GAZ-69, two GAZ-66, four motorcycles)
One target-acquisition battery (with Big Fred radar)
One howitzer battalion (290 personnel, 18 D-30 122mm howitzers, trucks)
One composite artillery battalion (240 personnel, 12 D-30 howitzers, 6 M-1975 MRLs).
One assault gun battalion (160 personnel, 31 ASU-85 assault guns, 6 trucks, 2 jeeps. ASU-85s probably being replaced by 2S9s)
One ATGM battalion (six officers, 60 enlisted men, 12 ATGM BRDM, two GAZ-69, four GAZ-66, two motorcycles)

Airborne regiment
Total strength: 1,500 personnel, 90 BMDs, 9 BMD-2 M1979/1s, 10 BMD-2 M1979/3s, 4 BRDM-2s, 9 ATGM-armed BRDMs, 6 120mm mortars, 36 SA-7/14s, 6 ZU-23s, 111 RPG-7V/16Vs, 18 AGS-17s, 83 RPKS-74s, 19 GAZ-69/UAZ-469s, 96 GAZ-66s, 64 ZIL-130/131s, 2 Ural-375Ds, 6 KrAZ-255Bs, 5 UAZ-452s, 3 GAZ signals vans, 12 ZIL maintenance vans, 4 GAZ-69RKh.
One regimental headquarters (28 officers, 41 enlisted men, 3 SA-7/14s, 2 RPG-16/7Ds, 2 RPKS-74s, 4 jeeps, 4 BMD M-1979/3s)
Three airborne battalions
One ATGM battery (four officers, 41 enlisted men, 9 RPG-7D/16Ds, 3 SA-7/14s, 9 ATGM BRDMs, 3 BRDM scout cars, 1 BRDM-2U command vehicle, 1 simulator van truck, 3 trucks)
One mortar battery (four officers, 56 enlisted men, six 120mm mortars, six RPG-7D/16Ds, 1 jeep, six GAZ-66s)
One air defence battery (three officers, 45 enlisted men, six ZU-23s, 3 SA-7/14s, 1 GAZ-69, six GAZ-66s)
One parachute rigging and resupply company (85 personnel, 30 GAZ-66s, 25 ZIL-130/131s, 6 KrAZ-255Bs, 12 POL trucks)
One anti-tank battery (four officers, 43 enlisted men, six RPG-7D, three GAZ-69, six GAZ-66, six SD-44 85mm auxiliary-propelled anti-tank guns)
One engineer company (three officers, 50 enlisted men, six GAZ-66)
One signals company (four officers, 47 enlisted men, eight GAZ-69, four motorcycles)
One NBC defence platoon (one officer, 17 enlisted men, three GAZ-69, three BRDM-2RKh
One medical company (eight officers, 24 enlisted men, two GAZ-66, five GAZ-69)
One reconnaissance platoon (believed to have a pathfinder role, two officers, 25 enlisted men, three BRDMs, three GAZ-69)
One material support company (six officers, 64 enlisted men, 36 ZIL-130/131, 2 Ural-375D with trailers, 4 GAZ-66, 4 UAZ-469)
One maintenance company (four officers, 30 enlisted men, five GAZ-69, five GAZ-66, one armoured recovery vehicle)

Airborne battalion
Total strength: 330 personnel, 30 BMDs, 3 BMD-2 M-1979/1s, 2 BMD-2 M-1979/3s, 30 RPG-7V/16Vs, 9 SA-7/14/16s, 6 AGS-17s, 27 RPKS-74s, 1 GAZ-69/UAZ-469, 10 GAZ-66s, 1 UAZ-452, 1 ZIL maintenance van.
One battalion HQ (5 officers, 9 enlisted men, two BMD M-1979/3s)
Three airborne companies
One signals platoon (1 officer, 17 enlisted men, 1 RPG-7/16, 3 motorcycles, 1 jeep, 2 R-107 radios, HF/UHF vehicle mount, 2 ground-air radios)
One supply and service platoon (16 enlisted men, 2 RPG-7/16s, 10 GAZ-66s)
One repair workshop (7 enlisted men, 1 maintenance van)
One medical aid section (1 *feldsherr*, 2 aid men, 1 UAZ-450/452 ambulance)
One mortar platoon (1 officer, 19 enlisted men, 3 82mm mortars [M-1937 or *Vasilyek*], four jeeps)
One air defence platoon (9 SA-7/14 launchers, detached to companies)

Airborne company
Total strength: six officers, 79 enlisted men, 10 BMDs, 1 BMD-2 M-1979/1, 2 AGS-17s, 9 RPG-7V/16Vs, 3 SA-7/14s, 9 RKPS-74.

Company headquarters (commander, political officer, technical officer, first sergeant, R-107 radio operator attached from battalion, BMD gunner, BMD driver, one BMD)

Three platoons (each with three BMDs, a platoon headquarters, one platoon leader, one NCO assistant platoon leader) and three squads (each of squad leader, RPKMS gunner and loader, RPG-7/16 gunner and loader, and two-man BMD crew. At least one squad per platoon [probably all three in Afghanistan] has an SVD-armed sniper.)

One SAM squad (3 men with SA-7/14 launchers, detached from battalion)

One weapons squad (7 men, 1 BMD M-1979/1, two AGS-17s)

All personnel except for primary gunners on crew-served weapons carry AKD 5.45mm rifles, two-man BMD crews use 5.45mm AKSU. In Afghanistan SVD-armed snipers can be concentrated in an anti-sniper squad. BMD numbers and organisation depend on the unit's mission. Division-level assets are normally attached to regiments on operational missions, and regimental assets are attached down to battalion, forming regimental and battalion combat teams (reinforced). ASU-85 platoons are often attached to first-echelon battalions.

Independent, non-divisional airborne units also exist, apparently. These include large weapons such as FROGs.

Air assault brigade

2,000-2,600 men, 18 D-30 122mm howitzers, 6 M-1975 122mm multiple rocket launchers, 24 120mm mortars, 24–45 SA-14/7 SAM launchers, 6 ZU-23 23mm anti-aircraft guns (possibly being replaced by SA-9s), 9 ATGM-armed BRDM scout cars, 14–18 manpacked ATGMs, 36 SPG-9 73mm anti-tank guns, 6 SD-44 85mm anti-tank guns, 81–150 RPG-16D anti-tank rocket grenade launchers, 24 AGS-17 30mm automatic grenade launchers, 111 RPK-74 light machine guns, 68 BMD airborne infantry fighting vehicles, 4 BRDM scout cars, 48 *Vasilyeks*.

One brigade headquarters,
Two airborne assault battalions (BMD-equipped)
Two airborne battalions (light)
One composite artillery battalion
One reconnaissance company
One anti-aircraft artillery battery
One engineer company
One signals company
One anti-tank battery (not in all brigades)
One parachute rigging and resupply company
One transport and maintenance company
One NBC defence platoon
One medical company
One supply company

Some brigades have three light and one BMD-equipped battalions (including 35th Brigade in 1985).

Lift requirements:

Full brigade without BMDs, 75 Hip, 35 Hook; full brigade with BMDs, 41 Hip, 125 Hook; rifle battalion, 13 Hip; rifle battalion team, 17 Hip; battalion mortar platoon, 6 Hook; BMD-equipped battalion, 37 Hook; brigade headquarters company, 3 Hip; artillery battalion, 24 Hook; air defence battery, 6 Hook; reconnaissance company (BMDs), 4 Hook; reconnaissance company (no BMDs), 2 Hip; engineer company, 3 Hook; support elements, 4 Hip.

Airmobile brigade

1,850 men, 32 Mi-8 Hip, 24 Mi-6 Hook, 71 GAZ-66 light trucks, 28 UAZ-469 jeeps, 6 120mm mortars, 36 SA-7/14 SAM launchers, 9 ATGM-armed BRDM scout cars, 21 manpacked ATGMs (Sagger or Spigot), 72 SPG-9 73mm anti-tank guns, 6 SD-44 85mm anti-tank guns, 114 RPG-16D anti-tank rocket grenade launchers, 90 light machine guns, 4 BRDM scout cars.

One brigade headquarters
Three airborne (light) battalions
One reconnaissance company
One anti-aircraft battery
One engineer company
One signals company
One mortar battery
One anti-tank gun battery
One ATGM battery
One NBC defence platoon
One transport company
One medical company
One supply and maintenance company
Under brigade command:
One composite helicopter regiment consisting of two heavy-lift helicopter squadrons (each of four three-Hook flights, being re-equipped with Halo), two medium-lift helicopter squadrons (each of four four-Hip flights)

Lift requirements:

Full brigade, 60 Hip, 36 Hook; rifle battalion, 13 Hip; rifle battalion team, 16 Hip; all batteries, 33 Hook; brigade HQ, 3 Hip; reconnaissance, 3 Hook; support elements, 9 Hips.

Independent air assault battalion

500 men, 14 BMDs, 6 120mm mortars, 12 *Vasilyek*, 6 SA-7/14, 6 Spigot, 6 AGS-17.

One headquarters
One BMD-equipped airborne company
Two airborne rifle companies
One mortar battery (120 mm)
One reconnaissance platoon
One signals platoon
One medical section

Possible attachments:
One 122mm howitzer battery
One Air Force guide party

Lift requirements:
Full battalion team, 15 Hip, 26 Hook; battalion team (no BMDs), 21 Hip, 13 Hook; rifle company, 4 Hip.

Airlift capability

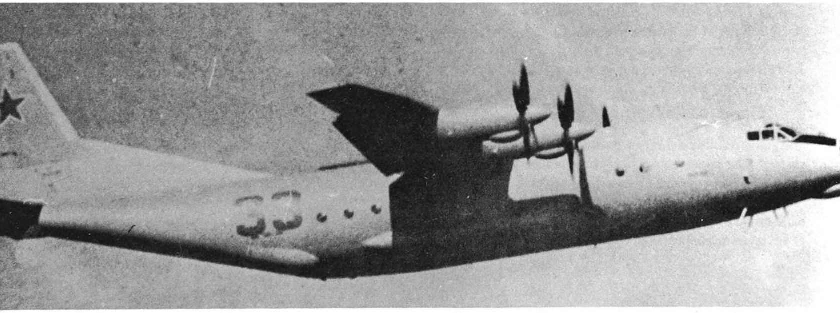
All Soviet military airlift capability is provided by the Military Transport Aviation (VTA) of the Air Force, supplemented by the resources of Aeroflot, the state airline. In the late 1970s the 1,200 VTA aircraft could lift two airborne divisions simultaneously over 480km or one division over 1,610km; 1,300 Aeroflot aircraft were available for follow-up use. Soviet medium and heavy airlift capabilities are estimated to have increased by 50% by the mid-1980s, with 1,800 VTA (including 260 Cub, 310 Candid, 50 Cock, 5+ Condor) and 1,200 Aeroflot (including 200 Cubs and Candids and 5 Condors) aircraft available. The replacement of twin-turboprop types by the An-72/74 Coaler has also added to light airlift capability.

Recent Soviet airlift exercises, including some to Ethiopia and Yemen in the late 1970s, have apparently been aimed at improving long-range capability. Reinforced by Aeroflot, VTA can sustain impressive airlifts, as it did during the 1973 Middle East war, the 1978 Ogaden fighting and in the invasion of Afghanistan in 1979.

The usual aircraft used by the airborne forces are the turboprop An-12 Cub, which can drop 80 paratroopers or two BMDs, and the turbofan Il-76 Candid, which can drop 150 men or three BMDs. Other aircraft – notably the huge An-22 Cock – are used for airlifts but normally do not drop paratroopers. The Cock can drop four BMDs or 300 troops.

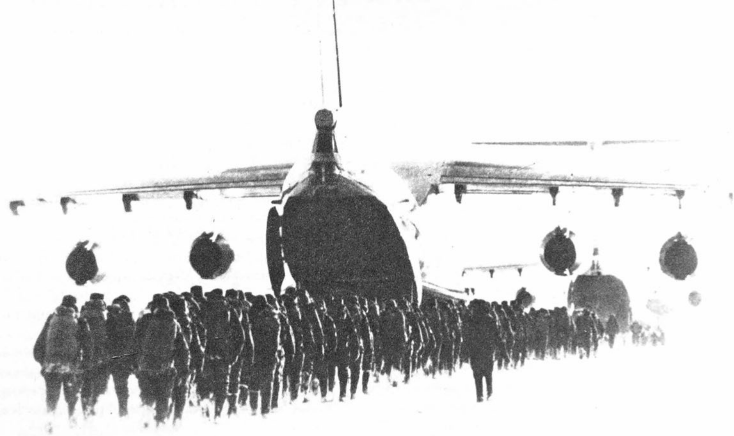
A total of 157 An-12 sorties would be required to airlift one BMD-equipped airborne regiment group, 90-115 for the regiment's combat elements alone. When supplies and spare aircraft are counted, this total will be close to 200 sorties. To air-drop a regiment would require even more sorties. One Il-76 sortie can often replace about two An-12 sorties.

An-12 Cub, standard Soviet tactical transport. *(US Department of Defence)*



VTA airlift aircraft

Type	Troops (max)	Payload (kg) (max)	Range (km) (max payload/empty)
An-12 Cub, turboprop	105	20,000	550/5,000
An-22 Cock, turboprop	350	80,000	5,000/10,950
An-26 Curl, turboprop	38	5,500	980/2,930
An-74 Coaler, jet	45	10,000	1,000/3,800
An-124 Condor, jet	88+	150,000	4,500/16,500
Il-14 Crate, piston	32	3,300	400/3,200
Il-18 Coot, turboprop	90	13,500	3,700/6,500
Il-76 Candid, jet	200	40,000	5,000/9,700



The Il-76 Candid is supplementing the An-12 Cub as the standard tactical transport for Soviet airborne forces. *(US Department of Defence)*

Parachutes

All paratroopers have main and reserve parachutes. The main D-1 parachute can be used above 150m altitude from aircraft flying at a maximum speed of 189kt. The D-3, an improved version introduced in the 1970s, is believed to be used for lower altitudes (reported to be as low as 100m) and higher speeds, especially when dropping from Candids. The steerable D-5 parafoil parachute is used for high-altitude exits, low-altitude opening. Opening is by static line (four seconds delay) or manually. Rate of descent is 5m/sec. The chest reserve parachute is the Pz-41a, which can be used at speeds of up to 216kt and has a descent rate of 8m/sec. Special training parachutes are also used, as is a wide range of cargo parachutes.

Soviet paratroopers normally jump from the tail door of the transport. A small drogue parachute first opens and stabilises the paratrooper before automatic clips open to allow the main parachute to deploy at a preset height. This method produces less dispersion and a quicker drop, by allowing fast exit and making it possible for the aircraft to fly higher and faster than their Western counterparts, though with a greater risk of accidents.

The Soviets have made parachute drops at 100m (demonstrated in 1968) and 50m altitude (demonstrated in 1986). Tube-launched parachute technology has been used and may be deployed in the future.

ASU-57 and ASU-85 airborne assault guns

Vehicle	ASU-57	ASU-85
Introduced	1957	1962
Weight	3,350kg	15,500kg
Length	4.995m	8.49m
Height	1.180m	2.1m
Width	2,086m	2.8m
Ground pressure	0.35kg/cm²	0.44kg/cm²
Max road speed	45km/h	44km/h
Fuel capacity	140 litres	250 litres
Fuel consumption	0.56 litres/km	0.96 litres/km
Road range	250km	260km
Fording	0.7m	0.9m
Gradient	30°	29°
Vertical obstacle	0.5m	1.1m
Trench	1.4m	2.8m
Track	3.0m	2.66m
Ground clearance	0.2m	0.4m
Engine	4-cylinder petrol, 55hp, water-cooled	6-cylinder diesel, 290hp, water-cooled
Gun	57mm Ch-51 or Ch-51M	85mm D-70
Calibre length	73cal	55cal
Rate of fire (max)	12rpm	3–4rpm
Rate of fire (sustained)	6rpm	2rpm
Max range (HE)	6,000m	15,300m (requires 29° gradient)
Max effective range (APHE)	1,100m	950m
Max effective range (HVAP)	1,250m	1,150m
Ammunition types	BR-271SP APHE-T, BZR-27 APHEI-T, BR-271P HVAP-T, O-271 Frag-HE Shch-271 canister	as D-48
Muzzle velocity (HE)	706m/sec	similar to D-48
Muzzle velocity (APHE)	990m/sec	"
Muzzle velocity (HVAP)	1,255m/sec	"
Shell weight (HE)	3.7kg	as D-48
Shell weight (APHE)	3.1kg	as D-48
Shell weight (HVAP)	1.8kg	as D-48
Rounds carried	30	40
Armour penetration @ 500m	APHE = 106mm HVAP = 140mm	similar to D-48
Armour penetration @ 1,000m	APHE = 85mm HVAP = 100mm	similar to D-48
Co-axial MG	can be attached	7.62mm PKT
Elevation	−5°/+12°	−4°/+15°
Traverse	22°	12°
Armour (glacis plate)	6mm @ 60°	40mm @ 60°
Armour (hull side)	6mm @ 0°	15mm @ 30°
Crew	3	4

Left An ASU-57 with the standard-production double-baffle muzzle brake for its Ch-51M 57mm gun. Its light construction is evident. *(US Army)*

An ASU-85 provides mobility for paratroopers in Prague, 1968. Like all invading armour in 1968, it is marked with a white cross for aerial recognition. *(US Army)*

The ASU-57 and ASU-85 (*Aviadesantnaya Samokhodnaia Ustanovka*, airborne self-propelled mount) airborne assault guns provide armour support for Soviet paratroopers. Both vehicles are old designs, and their guns do not pose a threat to modern tanks except at short range. An An-12 tactical transport can carry two ASU-57s or one ASU-85. Each ASU-57 is dropped on a pallet with four main and four stabilising parachutes. Retro-rockets fitted to the pallet slow its descent immediately before landing. Once on the ground, the crew, parachuted separately, run to the vehicle, collapse the parachute, unfasten it from its pallet, and can be ready for action in minutes. While the ASU-85 is capable of being air-dropped, it is normally flown to an airhead instead. The ASU-85 can also be lifted by Mi-6 Hook and Mi-10 Harke helicopters, and the ASU-57 by the Mi-8 Hip as well. By 1986–87 the ASU-85 was being relegated to the training role in the Soviet airborne forces and had been phased out of the Polish airborne brigade (formerly division).

This airborne capability has been achieved by reducing weight. The ASU-57's protection will not even keep out the rain. The ASU-85 has thicker armour but is still vulnerable to 50cal rounds in the side and rear.

The first production ASU-57s were of steel and more heavily armoured than the service model, which uses both steel and duralumin alloy and has a 55hp four-cylinder passenger car petrol engine. Unlike the ASU-85, it lacks an NBC defence system. Its large, open top, frequently covered by a tarpaulin, makes it vulnerable to artillery. The engine and transmission are front-mounted, as is the drive sprocket. The running gear consists of four road wheels and two return rollers per side. Three paratroopers can be carried in the open rear compartment, and they can mount a machine gun to fire alongside the 57mm. It lacks amphibious capability, and the entire vehicle is comparatively primitive.

Although obviously obsolescent, the ASU-57 is reported to have been instrumental in the victory in the Ogaden in 1978. It also appears to remain in service with Soviet airborne forces, used possibly for training or held for tactical situations requiring an armoured vehicle lighter than a BMD.

The unarmed command version of the ASU-57 was in limited service until being replaced by command BMDs. It has additional radios and an extendable canvas tent mounted at the rear.

The ASU-85 is a much more useful vehicle than the ASU-57. Its box-shaped, low-silhouette hull with a sharply

sloping glacis is mounted on a chassis which has the same rear-mounted engine, gearbox, suspension and track arrangement as the PT-76, lacking its amphibious capability. Optics are apparently similar to those used on the T-62, and include similar night vision devices. To compensate for the lack of visibility from the non-rotating fighting compartment, there is a vision block on each side of it, plus three for the driver and one for the commander. Large external fuel tanks are usually hung on the rear. Smoke is generated by two drum-like BDSh smoke generators at the rear of the vehicle.

The main weakness of these vehicles is their armament. The 57mm gun is basically the M-1943 ZIS-2, which proved quite effective against the *panzers*, achieving a 3-1 kill ratio in its towed form. Today, however, its armour penetration is inadequate, and outdated sights reduce accuracy except at close range. The original 57mm Ch-51 gun mounted on the ASU-57 had an unusual large, 34-slotted muzzle brake, while the later and more standard Ch-51M had a double-baffle type. The ASU-85's D-70 85mm/55-calibre gun is a development of the D-48 and can use the same ammunition. It features a double-baffle muzzle brake and a bore evacuator. Even with its HEAT and HVAP rounds it has only a limited capability to defeat modern tanks. As with the 57mm, its traverse and elevation are limited and hand-operated. The day sights are basic TShK-2-79-11 telescopic equipment.

A 12.7mm anti-aircraft machine gun was retrofitted to ASU-85s in the late 1970s. The ASU-85 is probably being replaced by the 2S9 120mm SP mortar.

Combat usage and weapons effectiveness

The ASU-57 saw limited service with the Egyptian Army in 1967, and was used in the Ogaden in 1978. ASU-57s were used by the North Vietnamese Army in South-east Asia. ASU-57s and -85s were flown into Prague in 1968, and ASU-85s were airlifted to Kabul in 1979. In the course of the war, however, the ASU-85s have apparently been used primarily for defending Soviet garrisons around Kabul and are not often seen in the field; they may have been withdrawn. The ASU-57 has not been seen in Afghanistan. The accuracy of the 57mm and 85mm guns with modern ammunition is probably superior to that of the PT-76's 76mm gun.

Tactical employment

Both vehicles provide paratroopers with mobile armoured striking power, either as assault guns, supporting attacks with AP or HE fire, or acting as self-propelled anti-tank guns in the defence. Paratroopers can ride in or on both vehicles.

In the 1970s each airborne division's ASU-85 battalion increased from 18 to 31 vehicles.

BMD airborne infantry combat vehicle

Introduced	1970
Weight	6,700kg
Length	5.3m
Height	1.62–1.97m (variable)
Width	2.65m
Track width	0.23m
Clearance	variable
Ground contact	2.84m
Ground pressure	0.57kg/cm²
Fuel capacity	300 litres
Max road speed	61km/h
Water speed	10km/h
Road range	320km
Gradient	30°
Vertical obstacle	0.8m
Trench	1.6m
Engine	5D20 V-6 diesel, 300hp water-cooled
Transmission	mechanical, 5 forward gears, 1 reverse
Weapons (turret)	as BMP
73mm rounds carried	39
ATGMs carried	3
Elevation	−4°/+33°
Gun stabilisation	none
Armour (front)	15mm (hull) 23mm (turret)
Armour (sides)	18mm (hull) 19mm (turret)
Armour (rear)	16mm (hull) 19mm (turret)
Co-axial MG	7.62mm PKT
Hull MGs	2 × 7.62mm PKT

All figures apply to standard BMD or BMD-1.

"The introduction of the BMD to Soviet airborne forces has provided Soviet military planners with a force which is capable of the projection of meaningful military power beyond the borders of the Soviet Union." Lt-Col Joseph Dye, US Army.

The BMD (*Bronevaya Mashina Desantnaya*, airborne combat vehicle) is a lightened, smaller version of the BMP, with the same main armament, basic suspension and hull. The BMD's hull front is shaped differently, and the shorter bow gives it a distinctive snub-nosed, boat-like appearance. Although the BMD has one less road wheel per side than the BMP, it has 10km/h more road speed. The BMD is almost six tonnes lighter than the BMP. It has a rear-mounted engine and a hydropneumatic suspension with variable-height capability for air transport use. Six men can fit in the BMD's cramped passenger compartment, but two of these – the squad leader and one rifleman – normally sit forward, firing the two

front-mounted 7.62mm PKT machine guns. Most BMDs have no firing ports and only one vision block in the passenger compartment, but a few late-production versions (seen from 1976 onwards) have two BMP-style firing ports and vision blocks each side. The paratroopers in the rear compartment must dismount by climbing through the large roof hatch. There is no rear exit.

The pre-production version seen in 1970 had a square NBC filter cover on the right hull front. NATO designated it the "M-1970 light tank". The operational tests were lengthy, and there were apparently a number of faults to be corrected. The first production model, designated the BMD-1, appeared in 1973. It featured a circular NBC vent cover. Additional fuel cells could be fitted in the rear well. Starting in about 1976, BMD-1s appeared with one BMP-style gunport on each side of the troop compartment, with a third port, to cover the rear, positioned on the right-hand side of the fighting compartment top.

In the mid-1970s the Sagger ATGM was improved with the addition of SACLOS guidance; by the mid-1980s it was being replaced by Spigot, mounted on the turret roof. Instead of being fitted on its usual tripod (probably also carried on the vehicle), the standard Spigot launcher is inserted in a socket on the turret roof. The gunner must aim and fire with his head out of an open hatch.

The addition of the ventilation grill over the glacis plates of the BMD-1M, first seen in 1980, is reported to have been the result of combat lessons in Afghanistan, where firing more intense than any encountered in peacetime training resulted in gun gas build-up in the hull. While first production BMD-1Ms had standard BMD road wheels, a new pattern was introduced in 1982.

The two PKT machine guns may be capable of being fired by the gunner when the squad dismounts. The BMD's optics are apparently similar to those on the BMP, although it lacks the commander's infra-red searchlight. Late-production BMDs have a tow hook. Other characteristics are similar to those of the BMP. The BMD is fully air-droppable, both with and without a pallet.

The BMD was designed from the outset to be air-droppable by An-12 and larger aircraft. Its pneumatic suspension system can be folded up during air-dropping. Mounted on a modernised version of the PRS pallet used with the ASU-57, the PRSM-915, it is pulled out of the aircraft by a drogue chute. After the main canopy deploys, four probes extend below the pallet. When these touch the ground, retro-rockets fire, slowing touchdown. A radio beeper on the BMD then goes off to help the crew, landing separately, to locate it and get it ready to move, a process intended to take about 15min.

Other versions

Two turretless versions of the BMD are in service, both designated BMD-2 by the Soviets. These have a longer chassis, six instead of five road wheels, and five return rollers. The most common is the BMD-2 M-1979/1, an APC weapons carrier fitted with two dismountable AGS-17s and/or one 82mm mortar, and as a towing vehicle for *Vasilyeks*, ZU-23s and similar weapons. It has two bow-mounted 7.62mm PKT machine guns and firing ports, allowing it to act also as an APC. The BMD-2

BMD-1Ms armed with 73mm cannon and Spigot ATGMs parade in Moscow. Note the louvres on the front glacis plate, designed to disperse gun gas and added as a result of Afghanistan experience. *(US Army)*

M-1979/1 is used as a command and reconnaissance vehicle by airborne artillery units. Some BMD-2 M-1979/1 command vehicles carry an R-142 radio. The BMD-2 M-1979/3 is also known as the BMD-U or BMD-KSh. It is a command version, with a Clothes Rail radio antenna as well as land navigation equipment. It lacks the gunports and hull machine guns of the M-1979/1.

There may be a 30mm-armed version of the BMD-1, designated BMD M-1981/1 by NATO. It is reported to retain a one-man turret, unlike the BMD-2, and has a roof-mounted AT-4 Spigot in place of the usual SACLOS-guided Sagger. There are conflicting reports of the M-1981/1's use. Each airborne regiment is reported to have nine, though other sources state that they are limited to non-divisional formations. 30mm-armed BMDs are rare. There has been speculation that the notion is a hoax, but it is certainly a logical evolution in BMD design. The gun is the same as that used on the BMP-2. If the vehicle does exist, its other characteristics appear likely to be the same as those of the BMD-1.

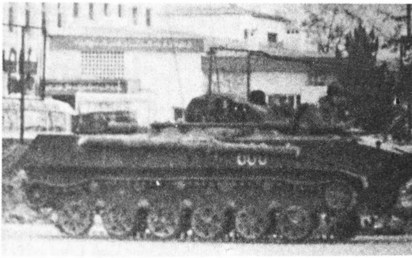
Total production, from a line believed to be at Izhevsk, is put at about 3,000. Production rates are relatively low. In 1983 it was reported that BMDs constituted 8% of the Soviet Army's infantry combat vehicle strength, the remainder being BMP-series vehicles.

Combat usage and weapons effectiveness

BMDs were used in the 1977-78 Ogaden war between Ethiopia and Somalia. Crewed by Cubans, with Soviet and East German "advisers," the BMDs were reportedly used as light tanks in the Ethiopian attack that finally forced the Somalis back across the border. The BMDs and ASU-57s were airlifted over terrain impassable to armour and dropped by parachute. Once an airhead was established they were delivered by transport aircraft. The BMD was apparently only able to operate as a tank because of the lack of Somali anti-tank weapons. The technical capability and characteristics of the BMD allowed the Cubans to achieve the surprise that the Soviet way of war emphasises, and this helped to bring victory.

BMDs have been used extensively in Afghanistan. The Soviet paratroopers that seized Kabul and the Salang Pass highway in December 1979 owed much of their mobility and firepower to the BMDs flown in with them. Known to the Resistance as the "little tank like a jeep", BMDs have been helilifted into remote areas for raids on Resistance supply convoys. The Soviet airborne takes its BMDs into the field for most operations: the 1984 Panjshir VII offensive brought many BMDs (alongside BTRs) into action. The Resistance is aware of the BMD's vulnerability to heavy machine guns, although their lack of armour-piercing ammunition prevents them from fully exploiting this knowledge.

With its identical main armament, the BMD has the same effectiveness and limitations as the BMP. However, the BMD lacks the BMP's infamous "bump" in the turret ring.



BMD-2 M-1979/3 with Clothes Rail antenna, used as a command vehicle during the 1979 takeover of Kabul. *(US Army)*

Tactical employment

The BMD can be used as an infantry combat vehicle, the way the BMP is used in the attack as well as defence. In the attack, when the paratroopers are not supported by tanks, the BMDs will probably precede the dismounted men, rather than following them like the BMP. Alternatively, in an assault when anti-tank resistance is slight, the BMD may function as a light tank. As much of the mission of the airborne involves raiding, ambushes and attacks on rear areas, the BMD is well suited for these operations, with its cross-country mobility, firepower and ability to carry an airborne squad. It is in these missions, rather than in breakthrough attacks, that the BMD is intended to be used. On the defensive BMDs will engage attacking armour from defending strongpoints, and will probably be used as a counterattack force.

In addition to a homing device to locate its BMD, each airborne squad has three R-255PP radio receivers, permitting every other trooper to receive voice orders.

Foreign usage

The ASU-57 is used by the Soviet Union and Yugoslavia, although a number were supplied to Vietnam, Egypt and Ethiopia. The ASU-85 is used by the Poles as well as the Soviets. The BMD is used by the Soviets, but it is unclear what happened to those – and the ASU-57s – used by the Cubans in Ogaden. The US Army has at least one ASU-57, Canada at least two.

Chapter Sixteen
Infantry weapons

"There is no place in war for delicate machinery."
(A.P. WAVELL)

Bullets from Soviet rifles and machine guns killed half of the two million German soldiers who fell on the Eastern Front. Almost half of the US casualties in Vietnam were from bullets, most of them fired from Soviet-built infantry weapons. Throughout the world it is unshaven men brandishing Kalashnikovs – their banana-shaped magazine silhouette already a universal symbol of revolution – rather than masses of tanks that topple governments and shape world events. These weapons are simple, reliable, rugged and highly effective.

Soviet infantry weapons are intended for suppressive fire. The Kalashnikov assault rifles are basically improved submachine guns using a medium-power cartridge. Neither the submachine gun nor the assault rifle is accurate or long-ranged, but few of today's soldiers have the skill or training to take advantage of long-range accuracy. However, even if a rifleman cannot hit anything, he can at least point his weapon at the enemy and spray – which is all the Soviet Army requires him to do. Only snipers need individual accuracy. In the attack, suppressive fire delivered on foot or from vehicles keeps enemy heads down until they can be defeated by close assault. The over-the-shoulder straps of all Soviet infantry weapons allow the use of "marching fire" – suppressive fire from the hip. In defence, infantry weapons pin down attacking infantry and separate them from their armour, which can be destroyed by anti-tank weapons no longer threatened with suppression by the enemy infantry. These simple tactics are demanded by the Soviet emphasis on speed in the offensive, the degree of training that can be expected from their conscript riflemen and their equally green squad leaders, and the design of their infantry weapons. They are also a response to a command and control problem. Studies have shown that most riflemen do not fire their weapons in combat: in the US Army during the Second World War only 10–15% usually did so. However, soldiers armed with automatic weapons tended to blaze an entire clip away rather than remain silent. The Soviets, aware that their command and control at low level is limited, optimised their weapons and tactics so that all a soldier has to do is blaze away, suppressing the enemy with weight of fire. Some of the bullets fired have to hit.

The Soviet concept of a complementary mix of weaponry extends to the lowest levels. The main anti-infantry power of a Soviet squad is its one or two machine guns, while the RPG-7 or 16 is the anti-armour punch. The remaining assault rifle-armed squad members provide suppression, guard the machine guns and RPG, and make close assaults. For the rare occasions when aimed, long-range single shots are required, each platoon has a sniper.

Soviet motorised rifle units are largely self-sufficient on the battlefield, as they will probably not be able to call on heavy weapons to supplement their firepower in many situations. However, they are almost always used in a combined-arms force. There is no Soviet "foot" infantry. Every Soviet motorised rifle squad will have its APC or BMP in direct support, usually 300–400m away. In addition, tank support is normally provided. As is the case with all Soviet units, motorised rifle squads and platoons fight as part of a combined-arms team.

The future

The Kalashnikov-system weapons are likely to remain in service for the remainder of the century, the pace of replacement of anything as widespread as infantry weapons in the Soviet Army being nothing short of glacial. The Soviets will probably continue the "high–low mix" policy that has served them so well in other areas, with older, cheaper systems being retained for use by low-readiness formations and for export. The 5.45mm weapons will probably continue to supplant the 7.62mm × 39-calibre weapons, and the AKSU most of the pistols.

The use of heavy weapons such as the BG-15, NSV and AGS-17 is likely to increase, as is that of night or telescopic sights. Selection of a 5.45mm LMG rather than a 7.62mm GPMG for use by motorised rifle squads parallels similar decisions by the US and British armies. While the PKM has been supplanted at squad level in units using 5.45mm weapons, it is likely to remain in a broad range of other applications, ground, vehicle and helicopter-mounted. New grenade designs – possibly the RGO and RGN – may

supplement the F1 in the next decade. The F1 is however likely to remain in service as the low-cost, low-technology option. The anti-tank grenades will continue to be replaced by the RPG-18 and RPG-22.

Infantry weapons in Afghanistan

Counter-insurgency fighting is infantry fighting. For all the importance placed on economic and political action, or helicopters and massed firepower in combat, it is infantry weapons in the hands of the men on the ground – motorised rifle, airborne, air assault, engineer, *Spetsnaz* and motor transport troops – that have had most influence in the war in Afghanistan.

Characteristically, the Soviets take a systems approach to infantry weapons. Each weapon and category of weapon is looked at not individually but in the context of all Soviet military hardware. In Afghanistan, however, the full weight and range of the available weaponry cannot be effectively applied. As a result, the systems approach to infantry tactics has led to difficulties in adapting to combat conditions in Afghanistan.

Dismounted infantry has had to become more self-reliant, both tactically and in terms of weapons, and to be able to use air mobility. This is important because the reliance of motorised rifle tactics on close support from armoured vehicles means that Soviet mechanised forces in Afghanistan have been roadbound, the high ground often being conceded to the Resistance. Further, the early fighting showed that the weapon proficiency of Soviet troops, especially the recalled reservists, was poor, especially in the areas of accuracy and fire discipline. This contributed to a number of tactical defeats in 1980.

Not only were the Soviets facing a war they had not prepared for, and for which their forces were unsuited, but the enemy was certainly not what the Army had been trained to fight. This was reflected in the fact that the early-war Resistance was able to inflict a great many casualties at long range with aimed rifle fire. While Afghans on the whole are not good shots, lacking training and practice ammunition, there were enough with a steady hand and a well loved Lee–Enfield to make the Soviets realise that they had to find a solution to complement the "systematic" one. While the Soviets have not traditionally emphasised long-ranged single-shot fire, the need to deal with Lee–Enfield-armed Afghans led to an approximate

Afghan guerrillas display their hardware, which includes an F1 hand grenade and an RPG-16 with bipod folded in travelling position. *(US Information Agency)*

tripling of the number of SVDs in motorised rifle and airborne companies. They are reported to be concentrated into one squad, giving the company commander an anti-sniper force.

In the Soviet Army company commanders are small cogs in a large machine. But in a guerrilla war they are the men on the spot. In Afghanistan, company commanders realised that their combined-arms forces of tanks and BMPs or BTRs were limited in what they could do against the Resistance. As a result they acquired additional heavy weapons, in the form of AGS-17 grenade launchers and NSVT heavy machine guns, both of which were capable of high-angle fire, which the vehicle-mounted weapons were not.

The increased importance of infantry weapons went hand in hand with recognition of the need for extended dismounted operations. The Soviets reached this conclusion early, but found that implementing it was a different matter. By 1980 they had started to realise the importance of seizing the high ground, as most roads run through valleys. This was often accomplished by troops inserted by helicopter along the route of the column in a revival of the Indian Army practice of "cresting the heights". When helicopters were not available, the slopes had to be climbed. But whatever the means of movement, encounters with Afghans in such situations led to a desire for as much firepower as could be carried. Thus it was that Soviet light forces came to carry more AGS-17s (especially when operating from helicopters), RPG-7s, RPG-16s and RPG-18s. Additional PKM and RPK light machine guns were carried, along with RPO and RPO-A flame rockets. The BG-15 grenade launcher continued the trend.

Despite these improvements, there has been a tendency by motorised rifle troops not to dismount and engage the Resistance, even when this would have resulted in outflanking them. Rather than taking aggressive and effective dismounted action, Soviet motorised riflemen tend to blaze away through the firing ports of their BMPs and BTRs. But a force confined to such vehicles could not surprise or surround Afghans, or make use of fresh intelligence. To do that required forces that could move quickly or quietly. This led to the increased use of special operations tactics, carried out by a wide variety of troops, not just *Spetsnaz*, reconnaissance and airborne. Since 1984 motorised rifle subunits have carried out more dismounted operations, either supported by vehicles or inserted by helicopter. The use of silenced infantry weapons has become more widespread, as has the use of body armour by troops fighting from vehicles or helicopters.

Soviet initiatives in the use of infantry weapons in Afghanistan have represented an attempt to acquire greater self-sufficiency in firepower. Aware of the limitations of mechanised combined-arms forces, they have placed more emphasis on specialised anti-guerrilla light infantry. The additional firepower needed by such forces has come from greater numbers of automatic weapons (LMGs), the use of anti-tank (RPGs) and heavier weapons (NSVs and AGS-17s), better use of existing weapons (SVD-armed anti-sniper squads), and the introduction of new weapons (suppressors and BG-15).

Assault rifles

Weapon	AK-47	AKM (AKMS)	AK-74 (AKS-74)
Calibre	7.62mm	7.62mm	5.45mm
Barrel length	41.5cm	41.5cm	41.5cm
Weight (loaded)	4.81kg	3.76kg (2.96*)	3.90kg (3.6)
Weight (empty)	4.31kg	3.26kg (3.46)	3.40kg (3.1)
Length	86.9cm (64.5)	88.8cm (65.3)	94cm (64)
Cyclic RoF	600rpm	600rpm	600rpm
Practical RoF (auto)	100rpm	100rpm	100rpm
Practical RoF (semi-auto)	40rpm	40rpm	40rpm
Max range	800m	1,000m	800m
Max effective range (auto)	200m	200m	300m
Max effective range (semi-auto)	300m	300m	450m
Ammunition types	ball, tracer, blank, API, grenade launch	as AK-47	ball, incendiary-tracer, ball-tracer
Muzzle velocity	710m/sec	715m/sec	900m/sec
Cartridge	7.62 × 39 intermediate	as AK-47	5.45 × 39 intermediate
Unit of fire	300 rounds	300 rounds	300 rounds
Carried by soldier	120 rounds	120 rounds	120 rounds
Magazine	30 rounds	30 rounds	30 rounds

* Figures in parentheses for folding-stock AK-47, AKMS and AKS-74 respectively; length is with stock folded.

Soviet-built AK-47 7.62mm assault rifle. *(US Army)*

AKM 7.62mm assault rifle. *(US Army)*

AKMS 7.62mm assault rifle with folding stock, shown extended in firing position. *(US Army)*

The Kalashnikov assault rifles have been the most widely used and most successful of post-war small arms. The three 7.62mm versions all share the same basic characteristics: the Kalashnikov action, automatic fire, 30-round "banana" magazine, and the intermediate cartridge. The original AK-47 has been replaced in the Soviet Army by the AKM and AKMS, which are lighter, easier to produce and maintain, have their rear sights set for ranges up to 1,000m rather than 800, and have straighter stocks. The new weapons can employ an NSP-2 night sight and a knife-bayonet that, unlike the AK-47's straight bayonet, can function as a wire-cutter. The AKMS is the folding-stock version of the AKM, and is the standard weapon of motorised rifle and airborne units. The intermediate round used with all of these weapons is lighter and less powerful but faster in operation than full-sized rifle ammunition. In addition, it has much greater range, destructive power and accuracy than the pistol rounds used in most submachine guns. The AK-47, first of the series, was introduced in 1949 to replace wartime submachine guns. Designed by Mikhail Kalashnikov, it was an adaptation of the German MP43 and MP44 assault rifles. It proved so successful in Soviet service that it also replaced the SKS carbine, the post-war replacement for the Moisin-Nagant bolt-action rifle. The AKM and AKMS are simply upgraded versions of the basic design.

The ruggedness, simplicity and ease of construction of these weapons has led to their almost universal acceptance. The North Vietnamese and Arabs, and guerrilla and insurgent forces, have even less time than the Soviet Army

Wooden-stock AK-74 5.45mm assault rifle fitted with a plastic 30-round magazine and standard over-the-shoulder sling to allow fire while marching. *(US Army)*

A well worn AKS-74 captured by Afghan guerrillas, who call this weapon the "Kallikov". An all-black version with ribbed foregrip, possibly East German-made, has been reported in Afghanistan. *(US Information Agency)*

for sophisticated training and individual marksmanship. Their logistical support is often tenuous; a weapon with a high maintenance requirement is worse than no weapon at all. Simplicity and serviceability, while hard to quantify, are frequently more important than high performance in combat, when a jammed or ammunitionless rifle often results in a casualty. AKMs have functioned normally even after total immersion in mud or water. They have only a few weaknesses. The exposed gas tube is easily dented, which can cause malfunctions due to uneven gas pressure distribution. Sustained firing causes overheating, making the weapon hard to handle, and rounds sometimes "cook off" in the chamber.

Despite their simplicity, Soviet-built Kalashnikovs exhibit a high degree of workmanship. The interior of the barrel is chromium-plated, which reduces wear and fouling and makes it easier to clean. The receiver (the main body of the gun) of the AK-47 was originally milled from solid steel. In the AKM this was replaced by a simpler press-formed sheet-steel receiver, and the bolt and bolt carrier were rust-proofed, rather than being left bright steel as in the AK-47.

The 5.45mm-calibre series of Kalashnikov assault rifles – the wooden-stock AK-74 and the folding-stock AKS-74 – were approved in 1974 and first paraded in 1977. The latter can have either a side-folding plywood buttstock or a similarly folding metal triangle; the second version is also known as the AKD (*Automat Kalashnikov Desantniia*, airborne automatic Kalashnikov). These weapons can be distinguished from their 7.62mm predecessors by the two-port muzzle brake (which greatly reduces the otherwise considerable recoil, flash and climb produced by automatic fire) and orange-brown plastic 30-round magazine, which is slightly shorter and less curved than that of the 7.62mm rifles. The AKS-74's tubular folding stock with narrow buttplate differs from the T-shaped stamped-metal folding stock of the 7.62mm rifle.

5.45mm rounds include ball, ball-tracer and incendiary tracer. The 50-grain tracer projectile has an 800m burn-out range. The PS ball projectile weighs 53.5 grains (10.2g); the charge weighs 23.0, ±1.5 grains. It has a 3mm-long internal air space, the result of the unhardened steel core being covered by a thin lead coating that does not fill the entire point; a 3mm-long lead plug lies between the steel core and the air space. This, plus its high velocity, means that the 5.45mm bullet can do terrible damage: the

Afghans call it "the poison bullet" because so few of those hit by it survive. This results from the fact that the internal mass shifts forward when the bullet strikes solid tissue, imparting to it an erratic path. The nose also has a tendency to bend as a result of this internal movement.

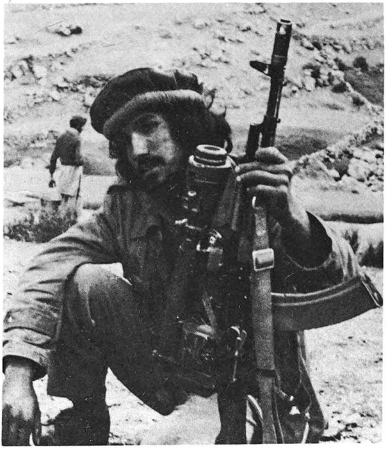
The tight rifling twist (1 in 203) of the AKS-74 contributes to a high muzzle velocity, which not only provides an extra 100m effective range compared with the 7.62mm versions but also gives better armour penetration: a 5.45mm Kalashnikov is reported to be able to penetrate a NATO 3.5mm test plate at 555m, twice the distance achieved with 7.62mm ball. However, it is also reported that the cartridge gives less performance than the NATO SS109 5.56mm cartidge, being more similar to earlier M193 5.56mm rounds. The thick rim of the cartridge case aids extraction.

Though most Category I motorised rifle units were using 5.45mm weapons by the early 1980s, the non-Soviet Warsaw Pact armies have been slow to receive them. Only East Germany is believed to have received them, starting in 1986. In Afghanistan they have been in service since the start of the war, especially with the paratroopers; combat (but not service support) units had been re-equipped by 1984–85. The Afghan Resistance calls the 5.45mm weapons "Kallikov", to distinguish them from the 7.62mm Kalashnikovs. This may reflect Soviet Army usage, as most Resistance nicknames do. "Kallikovs" are valued both as weapons and as marks of combat prowess: unlike 7.62mm weapons, which can come from outside aid or DRA ralliers, 5.45mm equipment has to be taken from the Soviets.

By the mid-1980s the AK-74 had been seen with large image-intensifier night sights replacing the usual infra-red type. All Kalashnikov assault rifles can be fitted with active infra-red or passive image-intensifier night sights, bayonets, silencers and under-barrel BG-15 40mm grenade launchers.

Night vision devices seen on Kalashnikovs include the older active infra-red NSP-2, the NSP-3 first-generation passive night sight (weight 2.7kg, length 0.49m, magnification 2.7 ×, field of view 7°), and the PGN-1 passive night sight (usually used with RPG-7/16s; weight 3.5kg, length 0.54m, magnification 3.4 ×, field of view 5.7°).

AK-74 with an image-intensification night sight. *(Jamiat-e-Islami Afghanistan)*



Combat usage

Kalashnikovs have proved highly effective in almost every war, insurrection and rebellion in the last 25 years, though accuracy in any weapon using the M43 intermediate cartridge is less than that of comparable NATO weapons. The Soviet round has a trajectory higher than almost any modern service round and is not effective beyond 400m, and its accuracy falls off greatly even before that range. The short distance between sight blades makes fine aiming difficult at short range. Loose tolerances compound the problem. However, the lack of long-range accuracy is not as serious as might be thought. Few soldiers can hit anything over 200m away, and most firefights are at much closer range.

Combat veteran US paratroopers in Vietnam, recipients of much more realistic and longer training than the average Soviet rifleman, scored an average of four to six hits per 1,800 M-16 rounds fired at man-sized targets at 50m – and this was on a target range, without return fire. This can be taken to show that the Soviets are right in emphasising mass over accuracy. It also leads to a suspicion that individual AKMs are very inaccurate indeed. Soviet writings admit that "only one soldier in six" can hit anything through a vehicle gunport. While an AKM has a 50% probability on paper of hitting a stationary, mansized target at 300m on a target range, combat experience has shown that while the weapons are deadly up to 100m, effectiveness falls off rapidly over this range. Over 250m their effect is minimal. US Army marksmen, firing AK-47s resting on the ground at man-sized targets at 300m, hit with only one round in three.

Engagement sequence

To fire any Kalashnikov-action weapon the soldier first pulls the cocking handle to the rear, ensuring that the

chamber is clear. He then lets the bolt slam forward and, putting the selector level on "safe", inserts a magazine into the receiver well. He then pulls the cocking handle back and lets it slam forward, drawing the bolt back and chambering a round. He now sets the weapon for either automatic or semi-automatic fire. Then, taking aim through the extremely simple "vee" tangent rear sight and a hooded front-post adjustable sight, he fires. Unlike US Army service rifles, which are supposed to be used for semi-automatic fire, these weapons are normally fired in short bursts.

All Kalashnikov weapons are gas-operated. The gases produced when a round is fired are channelled from the firing chamber into the gas cylinder above the barrel, and the piston in the cylinder is pushed backwards by the expanding gas. The piston is attached to the bolt, which it pulls back, ejecting the spent cartridge through the ejector and cocking the firing hammer. As the bolt travels, it compresses a return spring which then pushes it forward, stripping off a new round from the magazine and feeding it into the chamber as it goes. The bolt then locks itself in the firing position with two rotating-block lugs which give a strong, rigid action and good extraction. All these moving parts are solidly machined and their number kept to a minimum. The weapon can be easily stripped. The recoil system and strong ejection allow the use of ammunition with differing characteristics and reduce jamming. The position of the gas cylinder above the barrel keeps the recoil thrust line low and reduces – but does not eliminate – muzzle climb when firing on automatic. Muzzle climb and recoil – the result of using inferior non-Soviet ammunition – caused some North Vietnamese soldiers to discard their AK-47s in favour of M-16s, which were easier on the small soldiers. Many of their US Marine Corps opponents, however, scorned the M-16 and used the AK-47.

In Afghanistan the Resistance makes extensive use of Kalashnikovs, ranging from captured 5.45mm weapons to a wide range of Soviet, Chinese, Egyptian and East European-made 7.62mm AK-47, AKM and AKMS rifles. The collapse of the DRA Army in 1978–80, when its strength fell from 80,000 to 25,000, provided the Resistance with its first Kalashnikovs. As recently as 1984, however, Lee–Enfields were still more commonly used. In many groups the older men retained Lee–Enfields while the younger men used Kalashnikovs; in 1988 Kalashnikovs predominated. East German-made weapons are the most prized.

Foreign production

Kalashnikovs are also produced throughout the Warsaw Pact countries, in China, North Korea, Yugoslavia, Finland and many workshops and factories in the Middle East.

Suppressed AKMS assault rifle

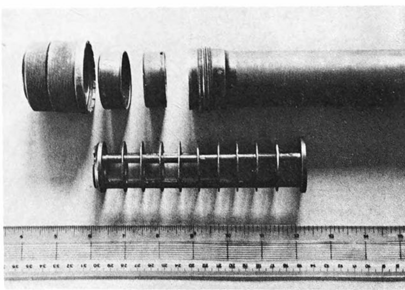
Soviet use of suppressors dates from the Second World War, when snipers used them for close-range work in battles such as Stalingrad. While suppressor technology is receiving increased interest in the West – the lethality of modern weaponry means that any means of reducing detectability must be pursued – the Soviets have not shown evidence of much post-1945 development in this area. However, extensive use is made in Afghanistan of 7.62mm AKMS assault rifles with suppressors, chiefly by special operations forces carrying out night-time ambushes and similar missions. In this application the weapon often also carries a night sight, possibly the standard NSP-3. The suppressor requires the use of UF subsonic 7.62 × 39mm rounds, identifiable by their green-black markings.

The suppressor used with the AKMS is not up to Western standards, and may even date back to the Second World War. Less effective than PRC, North Korean or Czech designs, it can however be easily screwed on and off the standard AKMS muzzle thread.

Firing cycle is semi-automatic only, as the subsonic ammunition is incompatible with the full Kalashnikov automatic cycle. Effective range is likely to be limited to 50m, and the lethality of the subsonic round may not be much more than that of a 9mm Parabellum.

The suppressor contains a series of baffles and elastomer wipes. Each wipe lasts about 10 rounds, obliging the user to carry a supply of spares and to break open the silencer to insert them, a time-consuming process.

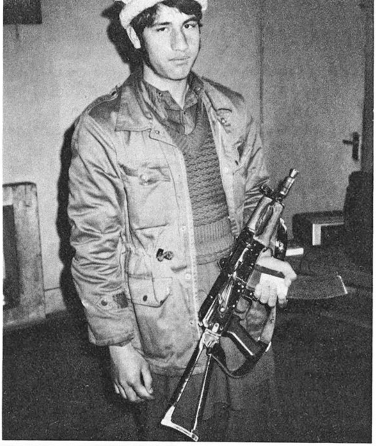
A suppressed AKMS with subsonic ammunition is estimated to have a noise signature of about 155–160 decibels, compared to 125–130 decibels for a Mark IIS "Silenced Sten" 9mm submachine gun of the type widely used by Western special operations forces.



Right Disassembled AKMS suppressor, without the plastic wipes that are required for its operation. *(D. Walsh)*

AKSU 5.45mm short assault rifle

Length (butt extended)	0.72m
Length (butt folded)	0.48m
Barrel length	0.20m
Weight (loaded)	2.8kg
Weight (unloaded)	1.8kg
Rate of fire (practical)	40–100rpm
Effective range	3–400m
Feed	30-round magazines
Cyclic rate of fire	800rpm
Muzzle velocity	800–900m/sec



Sayid Hakim of Jamiat-e-Islami Afghanistan captured this AKSU in action in Kabul province in 1983. *(David C. Isby)*

The AKSU (*avtomat Kalashnikov samokhodnaia ustanovka*, armoured-vehicle automatic Kalashnikov) is a shortened, lightened version of the AKS-74. It is used by AFV, helicopter and weapons crews and by support personnel, often replacing pistols. It is also referred to in the West as the AKR. A 7.62mm version, the AKMSU, has been produced in unknown numbers.

A light, handy weapon, the AKSU is similar to the shortened versions of assault rifles, such as the CAR-15, that have replaced submachine guns in the West. It uses standard 5.45 × 39mm rounds. Like the AKS-74, it has a large muzzle brake and flash-hider that is effective in reducing recoil, allowing the AKSU to be fired one-handed if necessary. Apart from its reduced length, it is basically the same as the AKS-74, the main difference being that the top part of the receiver is hinged to the gas-tube retainer block rather than lifting off on opening.

The AKSU has been used extensively in Afghanistan, where the Resistance has nicknamed it the "Krinkov".

7.62mm light and general-purpose machine guns

Weapon	RPK	PK	SGMT/SGMB
Calibre	7.62mm	7.62mm	7.62mm
Barrel length	61cm	65.8cm	72cm
Weight (bipod)	5.6kg	9kg	13.5kg (AFV)
Weight (tripod)	–	16.5kg	–
Length	104cm (82)*	108cm	115cm
Cyclic RoF	600rpm	650rpm	600rpm
Practical RoF	150rpm	250rpm	250rpm
Ammunition types	ball, tracer, blank, API	ball, steel ball, tracer, API, AP, ranging	as PK
Muzzle velocity	745m/sec	825m/sec	800m/sec
Cartridge	7.62 × 39 M43 intermediate	7.62 × 54R full power	7.62 × 54R full power
Effective range	800m	1,000m	1,000m
Armour penetration (AP round) @ 500m	6mm	8mm	8mm
Feed	magazine	belt	belt
Magazine/belt size	30/40/75 rounds	50/250 rounds	250 rounds
Unit of fire	1,000 rounds	2,500 rounds	2,500 rounds
Carried by squad (per gun)	1,000 rounds	1,000 rounds	–

* Figures in parentheses are for folding-butt, airborne version of RPK.

RPK 7.62mm light machine gun with 30-round magazine. (*US Army*)

PK 7.62mm general-purpose machine gun with bipod mount. (*US Army*)

SGMB 7.62mm machine gun as mounted on BTR-60P APCs, including collecting bag for spent cartridge cases. (*US Army*)

From 1926 to the 1950s the Soviets used developments of the basic DP-series light machine guns: the DP, DTM, DPM and RP-46, plus the heavier SGM series, firing the standard full-sized 7.62mm rifle cartridge. The post-war RPD was the DP design using the intermediate M1943 cartridge. Despite its bulk, the RPD was the standard North Vietnamese light machine gun during the Vietnam War, and is still standard issue in China and North Korea. However, like all the previous machine guns, it has been replaced over the last 20 years by two Kalashnikov-action weapons, the RPK light machine gun and the PK general-purpose machine gun series, which remain in front-line Soviet service.

The RPK was introduced in 1960. Basically an enlarged, bipod-mounted AKM, with many interchangeable parts, it used the M1943 intermediate cartridge and could fire standard AK magazines as well as its 40-round box and 75-round snail drum magazines. It retains the usual Kalashnikov ruggedness and simplicity. As with all Soviet machine guns, the gunner does not have to set head space or timing, making them simpler than Western models. The RPK, however, lacks an easily detachable barrel – a great drawback, as it overheats rapidly and wear is considerable at high rates of fire. Combined with the poor long-range characteristics of its ammunition, this makes the RPK inadequate. Nonetheless, it still remains in front-line Soviet service.

The PK series has much greater capability than the RPK. It is a general-purpose machine gun capable of sustained fire from a variety of mounts. Weighing almost twice as much as the RPK, it uses full-power 7.62mm cartridges, which means that squads using the PK must carry two different, non-interchangeable types of 7.62mm ammunition. This was probably unavoidable as a result of the different roles of rifle and machine gun rounds: machine guns must sustain fire at 1,000m and do not have to be as light as rifles. The PK series employs the basic Kalashnikov action, with a gas cylinder under the easily changed barrel. The modified feed system – based on that of the SGM – uses the strong ejection pull to handle the belted, full-size ammunition. All versions of the PK have little recoil and no tendency to climb when fired. Its construction is simple and robust, consisting of riveted stampings. When fitted on vehicles or tripod mounts, its belts are kept in 250-round boxes; otherwise 50-round magazines are used. The non-disintegrating belt can get in the way if the PK must be moved during fighting. Lighter and easier to use and maintain than the US M-60, the PK has 100m less effective range than the American weapon. Extensive tests of PKMs by the US Army at Fort Benning found the Soviet gun much better received than the M-60. The PKM's reliability was especially praised, its stoppage rate being negligible.

Some motorised rifle squads in BMPs have two bipod-mounted PKs or PKMs, improved models which are slightly lighter and easier to produce. The PKB and the improved PKMB are the respective tripod-mounted versions. The PKT is the standard vehicle-mounted light machine gun, and is the basic Soviet coaxial AFV weapon, replacing the 7.62mm SGMT/SGMB Gorunov machine gun still used on some older vehicles.

Combat usage

Soviet light machine guns have seen almost as much combat as the assault rifles, and have proved to be effective weapons in action. Unlike riflemen, machine gunners almost always fire in combat, and most casualty-causing bullets have come from machine guns. The Soviets know that the machine gun is the key to dismounted firepower.

A 6–9-round burst with a PKMB has a 50% chance of hitting a stationary, fire-team-sized target at 1,000m under firing range conditions (800m in the case of the PKM). The PKM has the same chance of hitting a standing man at 550m. The number of targets it can hit depends upon terrain and deployment. In Vietnam light machine guns seldom hit more than one target per burst. However, wartime German light machine guns proved capable of decimating whole battalions when firing from enfilading positions. Today's Soviet weapons are no less capable.

A PKM's chances of hitting a moving, man-sized target in the open with a 6–9-round burst (range and accuracy approximate to ±10%) are:

Range (m)	50	100	175	250	500	750	1,000
Chance of hit	97%	83%	69%	56%	42%	31%	3%

Light machine guns can be effective against unarmoured vehicles. With a six–nine-round burst a light machine gun has the following chances of damaging an unarmoured, stationary vehicle:

Range (m)	100	200	300	500	800	1,000
Chance (%)	95	70	60	45	35	15

If hits are scored, the target will be destroyed approximately 65% of the time.

The PK's full-size cartridge gives superior penetration. At close range it can penetrate 37mm of mild steel, 127mm of concrete, 178mm of sand and 280mm of earth, compared to 25mm, 100mm, 150mm and 229mm respectively for the intermediate round.

Tactical employment

While mounted, light machine guns are fired from the foremost gun port of BTRs, BMPs and BMDs. Whether fired from a gun port or mounted coaxially, the accuracy of

a machine gun fired from a moving vehicle is extremely low, even if moving over a paved surface, as the US Army found out in Vietnam. The main function of these weapons is suppression. When a squad dismounts, the light machine gunners stay in the centre of the squad skirmish line, close to the squad leader, with one AKMS-armed soldier acting as assistant gunner for each light machine gun. Light machine guns will be fired from the assault position, giving marching fire while advancing, which degrades accuracy but adds to the weight of fire.

On the defensive, machine guns are positioned on likely avenues of approach for dismounted attack, using interlocking, co-ordinated fields of fire. They will protect the RPG-7/16 against enemy small-arms fire. At night machine guns will be readied to fire on fixed lines.

Foreign manufacture

The RPK was built in Yugoslavia, Finland and East Germany.

RPK-series 5.45mm light machine guns

Length (overall)	1.04m
Barrel length	0.59m
Weight (loaded)	5.0kg (5.3)
Weight (empty)	4.6kg (4.9)
Cyclic rate	600rpm
Effective rate	50–150rpm
Fire	selective
Feed	75/40/30-round magazines
Ammunition	5.45 × 39mm
Muzzle velocity	960m/sec
Maximum range	2,500m
Effective range	800m

Figures in parentheses apply to folding-stock RPKS-74.

The introduction of the 5.45mm series of rifles in the mid–late 1970s was soon followed by the appearance of a light machine gun in the same calibre. This was the RPK-74, a 5.45mm version of the standard RPK 7.62mm weapon. There is a folding-stock airborne version, the RPKS-74, with a plywood side-folding stock identical with that of the AKS-74.

Both weapons are normally fed by 40-round plastic magazines (either in chocolate-brown plastic or heavier red-brown ABS fibreglass-reinforced plastic), though they can also accept the standard 30-round 5.45mm Kalashnikov magazine. The 40-round magazine makes prone firing difficult: almost all those seen in Afghanistan have damage to their bottom plates, caused by the gunner "hitting the dirt"; the gunner must also expose himself more than would be necessary with weapons feeding from the side or top. A 75-round magazine is reported to have been developed.

Technically, the RPK-74 and RPKS-74 follow their 7.62mm predecessors closely. They use the same action and have many of the same strengths and weaknesses, although the 5.45mm round, with its high muzzle velocity, has a longer effective range. The RPK's flash suppressor differs from that of the AKS. Like the 7.62mm versions, the RPKs lack a quick-change barrel, even though sustained fire will cause barrel overheating and possible "cook-off" problems. This suggests that the Soviets will have to retain the PKM series for use in the sustained-fire role. The RPK-74 and RPKS-74 can be fitted with an NSP or image-intensifier night sight.

Combat usage

RPK-series 5.45mm weapons have been extensively used in Afghanistan and Angola.

Tactical employment

In many of the units equipped with 5.45mm weapons, 5.45mm RPKs have replaced the 7.62mm PKM series as the squad-level light machine guns. Thus motorised rifle

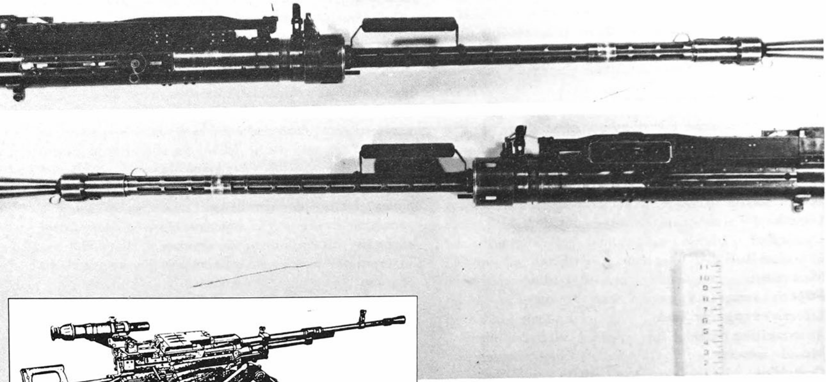
RPK-74 5.45mm light machine gun with 40-round magazine. *(US Army)*

squads are all 5.45mm-armed, increasing ammunition commonality but at the cost of losing the heavier PKM's long-range sustained-fire capability. It is possible that squads in other units using 5.45mm weapons retain PKMs in addition to or in place of the RPK-74 series. The airborne forces are believed to use the RPKS-74 as their prime squad-level automatic weapon. In action it is used much like the 7.62mm light machine guns.

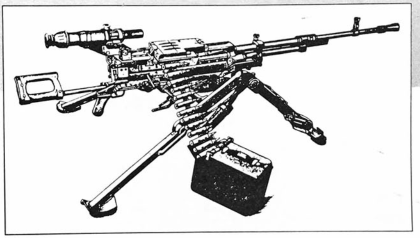
Heavy machine guns

Weapon	DShKM	KPV	NSV
Calibre	12.7mm	14.5mm	12.7mm
Barrel length	96.7cm	135cm	–
Weight (on AFV)	34kg	51kg	25kg
Length	158.8cm	200.7cm	156cm
Cyclic RoF	540–600rpm	600rpm	680–800rpm
Practical RoF	80rpm	150rpm	100rpm
Max range	7,000m	8,000m	8,000m
Effective range (AA)	1,000m	1,400m	1,400m
Effective range (ground)	1,500m	2,000m	2,000m
Ammunition types	ball,tracer, others	API, AP, HE	ball, tracer, AP, others
Muzzle velocity	830–850m/sec	1,000m/sec	845m/sec
Cartridge	12.7 × 108mm	14.5 × 114mm	12.7 × 108mm
Operation	gas	gas	gas
Cooled	air	air	air
Armour penetration (AP round) @ 500/1,000m	20/13.2mm	32/20mm	20/13.2mm
Feed	belt	belt	belt
Reaction time	6 sec	8 sec	6 sec
Reload time	15 sec	15 sec	15 sec
Max slew rate (°/sec)	90°	30°	90°
Max elevation	90°	35°	90°

The Afghan Resistance use both Soviet and Chinese versions of the DShKM, which remains their standard air-defence weapon. This Soviet-made example has a tripod mount with folding wheels. *(David C. Isby)*



Above KPV 14.5mm heavy machine gun, showing quick-change handle on barrel. *(US Army)*



Left NSV 12.7mm machine gun mounted on lightweight tripod for the direct-fire support role.

Below 12.7mm NSVT on a T-72 tank. It has the same type of sight as is fitted to DShkMs used in this role. *(US Department of Defence)*

Heavy machine guns are used either as the armament of scout cars and APCs or as anti-aircraft defence for tanks. The latter practice was abandoned by the US Army, but has recently been re-emphasised by the Soviets, probably as a result of the threat posed by ATGM-firing helicopters. T-62 tanks that were produced without anti-aircraft machine guns have been retrofitted with them. All new T-64 and T-72 tanks also have them.

The 12.7mm DShK and the similar DShKM (which differs only in having a simpler ammunition feed system) are pre-war designs. Originally used in a variety of ground mounts, they are now used exclusively in the Soviet Army as the standard tank anti-aircraft machine guns, although a new design of 12.7mm machine gun has been seen mounted on T-72s.

Designated the NSVT, this weapon is much lighter and more reliable than earlier 12.7mm designs. Incorporating a new action similar to that of the US M73, it has a quick-change barrel and a flash-hider. It uses boxed 60-round belts, possibly made up of new-model ammunition. Performance is similar to that of the DShKM, although practical rate of fire is increased to 100rpm.

The NSVT's development began in 1969 and it was introduced as a tank weapon in the early 1970s; the NSV, a lightweight-tripod-mounted version, has appeared since. The initials are those of the three designers: G.I. Nikitin, J.M. Sokolov and V.I. Volkov. The NSV is reported to be used as a source of long-range firepower by motorised rifle battalions in Afghanistan and East Germany. If this is so, it would parallel the re-adoption of .50-calibre weapons in US Marine and British airborne and Gurkha battalions in the 1980s.

The NSV's 25kg weight includes the 16kg 6T7 tripod mount but not the 11kg 50-round box. The 9kg quick-change barrel is usually changed every 1,000 rounds. It is also cheaper and easier to produce than the DShKM. Ammunition is usually AP, with every fourth round tracer.

On the T-72 MBT the NSVT is mounted on a ring-type mount on the commander's cupola, giving about a 270° traverse. It uses the same sights as the DShKM. The tripod mount has a 1.7kg 6×-power battery-operated SPP K10-T collimating optical sight, suitable for air defence use, and back-up "iron" sights. The mount can be adjusted from 0.31m to 0.41m in height and can be set for point or area fire. Weapon and tripod are said to be portable by two men.

The 14.5mm KPVT is used as dual-purpose main armament on BTR-60PB/70/80 APCs and BRDM-2 scout cars. It is a simple weapon, without adjustable head space or timing. Well sealed against dirt and dust, the body is basically a steel cylinder to which components are riveted or welded. The same basic gun as the KPV used in the ZPU-4, its heavy ammunition, originally used by anti-tank rifles, gives superior armour penetration. It has a chromed barrel.

While the KPV and DShK are old, heavy designs, they remain useful weapons despite their limitations. Light machine guns can be more effective against troops, and heavy machine guns lack the armour penetration of automatic cannon. Fitted with reflector sights, they retain a deterrent anti-aircraft role, disrupting attacks with streams of spectacular green tracer rather than shooting aircraft down. Heavy machine guns are still invaluable for long-range overwatch firepower. The introduction of the NSV/NSVT in the 1970s and the return of 12.7mm weapons to motorised rifle battalions show that the Soviets still value their capabilities.

Combat usage

Soviet heavy machine guns have seen extensive combat. The DShK was a standard weapon in the Second World War and Soviet, Czech and Chinese-built versions have been used worldwide since then. In South Vietnam the DShK and DShKM, named "51 calibre" by the Americans, were the primary anti-aircraft weapons. The Soviets have been on the receiving end of both weapons in Afghanistan.

Known as the *Dashika*, the DShK, in both Soviet and Chinese-built versions, is the primary anti-aircraft weapon of the Afghan Resistance. It has accounted for a significant number of the 1,000 enemy aircraft lost in the war up to 1987. This is despite improved Soviet tactics, the generally low level of Resistance anti-aircraft gunnery training and, most significantly, the armour of the Hind attack helicopter, which protects its vital components from 12.7mm rounds but not 14.5mm AP. The Resistance also uses these weapons for attacks on communist positions, troop columns and convoys. The DShKM is most effective against slow-moving helicopters: of 50 AH-1s hit by DShKM fire in South east Asia in 1967–69, only three were flying faster than 150kt and only two were higher than 2,000ft or lower than 100ft.

In addition to the NSVs used in motorised rifle battalions, heavy machine guns are widely employed in static defences by communist forces in Afghanistan. DRA forces use a Czech-built quad 12.7mm to defend vital outposts.

US Army simulator tests indicate that a pintle-mounted DShKM on top of a tank has the following chances of shooting down an AH-1 Cobra helicopter gun-ship, based on a 6–8sec burst at a crossing helicopter exposed for 20sec:

Range (m)	500	1,000	1,500
Chance of kill (%)	10	10	5

US Army estimates give a DShKM the following chances of scoring a "hit" (which could entail more than

one round striking the target) with a 9–15-round burst on a vehicle standing in the open:

Range (m)	100	200	300	500	800	1,000
Chance (%)	95	80	70	50	40	20

65% of the unarmoured vehicles hit will be killed, as will 30% of the armoured vehicles hit, if their armour can be penetrated.

If stationary, a DShKM engages ground targets with several short bursts. When firing on the move, long bursts are walked on to the target. Aircraft receive one continuous burst.

Foreign manufacture

The DShK was produced in Czechoslovakia and is still in production in North Korea, Pakistan and China as the Type 54. Some Chinese versions have an elaborate mechanical computing anti-aircraft sight.

SVD Dragunov 7.62mm sniper's rifle

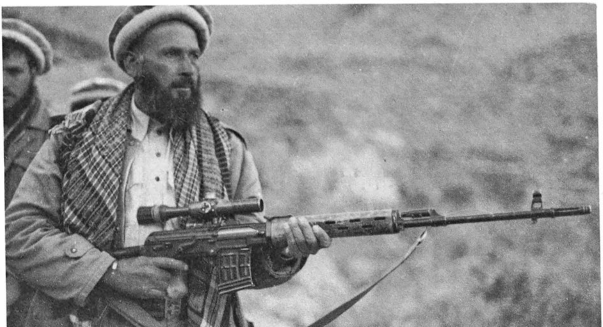
Barrel length	62cm
Weight (loaded)	4.52kg
Weight (empty)	3.72kg
Length	122.5cm
Maximum RoF	30rpm
Aimed RoF	4rpm
Max range	2,500m
Effective range	1,300m
Muzzle velocity	830m/sec
Cartridge	7.62 × 54R full power
Unit of fire	800 rounds
Carried by sniper	140 rounds
Magazine	10 rounds

The Soviets have emphasised the importance of sniping since the First World War and developed it into a fine art in the Second World War. The SVD Dragunov, however, is the first Soviet rifle designed especially for sniping. Introduced in the 1960s to replace the bolt-action Moisin-Nagant M1891/30, the Dragunov uses a single-shot or semi-automatic version of the basic Kalashnikov action and a full-size, long-range 7.62mm × 54R rimmed cartridge. Its PSO-1 sight is basically a four-power telescope with a 6° field of vision and an integral rangefinder that is lit at night. It has an infra-red viewing metascope that can detect infra-red light sources and can itself be used passively or in conjunction with an infra-red light source. A combination flash-suppressor and compensator reduces muzzle jump and flash. The skeleton stock with cheekpad improves balance. The pull of the trigger mechanism has been made more sensitive than that of other Kalashnikov-action weapons, and the trigger guard is large enough for the sniper to use mittens. The Dragunov can use the AKM's wirecutting bayonet. The standard of workmanship in the Dragunov is higher than that of other Soviet infantry weapons. It has a forged and milled receiver similar to that of the AK-47.

Combat usage

The effectiveness of the Dragunov depends heavily on the skill of the sniper. Snipers are trained in 45–60 days by their units, at least some of which have special sniper schools. They are normally selected from those who did well in pre-conscription DOSAAF target shooting, and receive much more intensive marksmanship training and target practice than the average Soviet soldier. US evaluations suggest that, with match-grade ammunition, the Dragunov design is capable of 1.5 minutes of angle accuracy or better, permitting head shots out to 300m and chest shots to 450m.

A Dragunov-armed sniper has the following chances of striking a standing, man-sized target:



Captured SVD 7.62mm sniper rifle in the hands of Panjshiri forces in Afghanistan. *(Jamiat-e-Islami Afghanistan)*

Range (m)	50	200	300	500	700	800	1,000	1,600
Chance of hit (%)	95+	95	90	80	60	50	20	5

A sniper could not engage more than two targets in 30 sec if he wanted to obtain this level of accuracy. The sight is used in much the same way as that of the RPG-7. Once range is determined, the appropriate setting is clicked on the elevation knob. Elevation and windage are handled by grid lines on the scope picture.

Accuracy varies with the type of ammunition used. The Dragunov can fire light ball, heavy ball, steel core, tracer and anti-tank incendiary ammunition, but only the ball rounds are accurate. The tracer, in particular, makes precise shooting difficult.

Both sides use SVDs (including Romanian-made versions) in Nicaragua.

Tactical employment

Each Soviet motorised rifle platoon has one Dragunov-armed sniper, who aids the suppressive fire by picking off high-priority individual targets at long range. Prime targets are officers, tank commanders, scouts, weapons crews (especially those of ATGMs) and messengers. The Soviets believe that harassing fire at long range, even if it does not cause casualties, will keep enemy heads down, and that knowing a Soviet sniper is watching their every move will reduce enemy morale.

In Afghanistan the Soviets are reported to have approximately tripled the number of SVDs in airborne and motorised rifle companies, often concentrating them into one squad.

In the defence the sniper takes up a position within the platoon strongpoint. He will engage individual enemy scouts either on foot or in vehicles at long range, so that the platoon does not have to fire its light machine guns. The sniper will move if necessary to avoid return fire. Concealment is stressed. Bushes and treetops often provide cover for snipers, and they use an effective, light camouflage screen. Snipers are also used in dismounted patrolling and raids. The Soviets believe that much sniping will take place at night as the enemy attempts to move under cover of darkness, and snipers may be aided by mortar flares and similar illumination.

Engagement sequence

The Dragunov is loaded and readied in much the same way as other Kalashnikov-action weapons. Fire is always by aimed single shots.

Makarov PM 9mm pistol

Barrel length	9.6cm
Length overall	16cm
Weight (loaded)	0.81kg
Weight (empty)	0.75kg
Rate of fire	30rpm
Max effective range	50m
Cartridge	9 × 18mm pistol
Operation	gas blow-back
Unit of fire	16 rounds
Carried by soldier	16 rounds
Magazine	8 rounds

Pistols are not significant weapons, and the Soviets minimise their use, with 5.45mm AKSUs now replacing them in most of their applications. Nevertheless, officers above platoon commanders and many AFV and weapons crews carry the Makarov PM 9mm pistol. The stopping power of the standard 9 × 18mm Makarov bullet is only about two-thirds that of the 9mm Parabellum; the Soviets are reported to have been experimenting with improved ammunition to increase this. A very compact piece, the PM has an eight-round magazine. Its design is based upon the German Walther PP pistol, with the same double-action hammer and slide-mounted safety catch. Light and handy, it is adequate for self-defence but does not measure up to heavier pistols for combat shooting. Its numerous small components make disassembly difficult. Its compactness makes the PM a weapon of choice among terrorists, most notably those who seized OPEC ministers in Vienna in 1975.

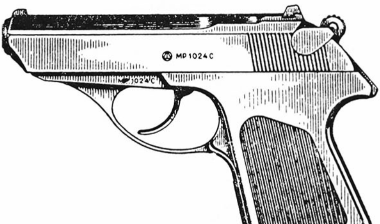
Right PM Makarov 9mm automatic pistol, with the characteristic star on the butt. *(US Army)*

PSM 5.45mm pistol

Barrel length	85mm
Length overall	160mm
Height	106mm
Width	17.5mm
Weight (loaded)	0.50kg
Weight (empty)	0.46kg
Cartridge	5.45 × 18mm
Magazine	8 rounds
Bullet weight	2.6g
Muzzle velocity	316m/sec

The PSM (*Pistolet Sazozaryadniy Malogabaritniy*) resembles a Walther PPK with a Mauser HSC-type trigger guard. Production is believed to have started in the mid-1970s. It is known to be used as a concealment weapon by bodyguards. Total production may be extensive if the PSM has been adopted by KGB Border Troops, police and military.

The PSM, with an action similar to that of the Walther PP, uses a centre-fire 5.45 × 18mm cartridge. A fixed-barrel blowback weapon with double-lock action, it was apparently designed to have as flat a profile as possible, even though this has required an ergonomically bad position for the safety lever. This suggests that the PSM is intended for special purposes requiring concealment rather than as a standard sidearm.



PSM 5.45mm pistol. *(Jane's Infantry Weapons)*

P6 suppressed 9mm pistol

The P6 silenced 9mm pistol (designation uncertain) is not in fact a version of a modified PM Makarov pistol, as has been reported. It is a special-purpose design, similar to the Chinese Type 64 and 67 silenced pistols and incorporating elements of the PM. It replaces a silenced version of the earlier APS Stechkin pistol, which had a wire stock.

P6 pistol with suppressor attached to muzzle. *(S. Fazle Akbar)*

The P6 has a 7.62mm(3in)-long integral suppressor around the barrel and a screw-on suppressor of the same length. The latter attaches at the muzzle by means of a thread-and-bayonet mount that gives a quick-removal capability. When not in use the separate suppressor is carried in a pocket in the holster. This is one reason why captured examples do not often display the full suppressor.

It is thought that the weapon fires standard Soviet 9 × 18mm pistol ammunition, which is subsonic at all but high altitudes. There appears to be a side lock. If so, the resulting reduced blowback would mean that the P6 is a single-shot, manual repeater; it could however be semi-automatic.

The suppressor that surrounds the barrel is filled with screenwire, as it is in the Chinese designs, with gas-bleed holes drilled in the barrel itself. Both the integral suppressor and the screw-on attachment have internal baffles but no rubber wipes, unlike the AKM suppressor.

The technology used in the P6 suppressors is certainly inferior by Western standards, being apparently based on dated Chinese designs.

The P6 has been used in combat in the Middle East and Afghanistan, where it is widespread among reconnaissance and special operations units.

AGS-17 automatic grenade launcher

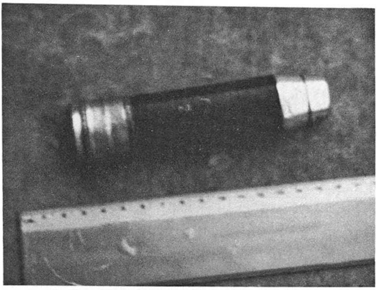
Length	0.84m
Width	0.31m
Height	0.145m
Max range	1,700m
Practical range	800–1,200m
Minimum range	50m
Rate of fire	40–58rpm (practical) 50–100rpm (maximum) 350–400rpm (cyclical)
Muzzle velocity	185m/s
Magazine capacity	29 rounds
Weight of magazine	14.7kg
Crew	3
Basic load	87 rounds
Max elevation	85°
Weight without tripod	17.66kg
Weight with tripod	30.4kg
Calibre	30mm
HE-Frag round	VOF-2 or VOG-17
Shell weight	0.3–0.4kg
Burst radius	7m
Year introduced	1975
Selective fire	auto or semi-auto

Helicopter-mounted version: muzzle velocity, effective range and rate of fire are likely to be higher.

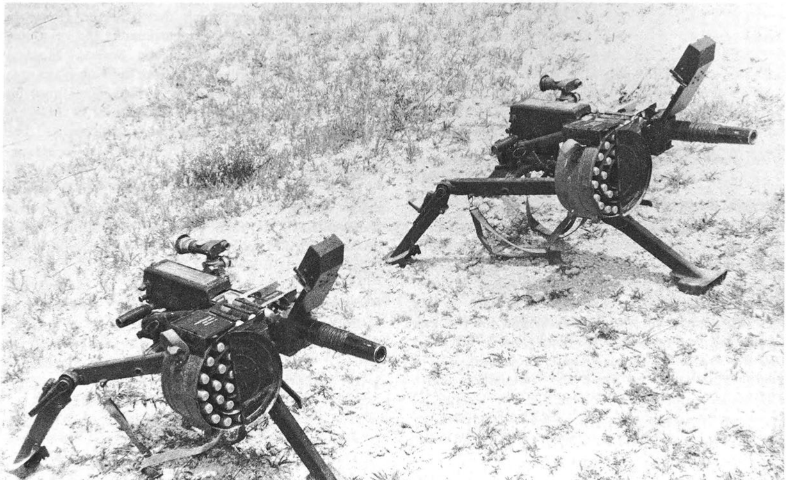
The AGS-17 *Plamya* (AGS = *Automaticheskiy Granatomyot Stankoviy*, tripod-mounted automatic grenade launcher; *Plamya* = "Flame") gives Soviet motorised rifle companies the ability to apply effective long-range area fire. It is a powerful supplement to the 7.62mm PKM general-purpose machine guns.

The AGS-17 has a close external resemblance to the Honeywell XM174 automatic tripod-mounted grenade launcher that was used in Vietnam from 1966, often mounted on river patrol boats. It is recognisable by its short barrel, large rectangular receiver with circular

VOF-2 HE grenade for the AGS-17. *(David C. Isby)*



AGS-17s captured from SWAPO by South African forces. They have their receivers open and hinged drum covers folded back to reveal their loads of grenades. *(Christopher Foss)*



magazine feeding into its right-hand side, and non-disintegrating link belt exiting on the left-hand side. Twin spade grips are fitted, and there are a small optical sight and an elevation quadrant on the left rear of the weapon.

The AGS-17 is normally mounted high on a light, low tripod. AGS-17s are often mounted externally on armoured vehicles, on top of the turrets of BTR-60PBs, BTR-70s and BMPs; these are apparently fixed mounts that rotate with the turrets. The weapons can be elevated or fired from under armour, although they must be reloaded externally. Some photographs from Afghanistan show BMD airborne infantry combat vehicles with what may be an AGS-17 mounted in place of its 2A20 73mm cannon.

A long-barrelled version of the AGS-17 is mounted on Soviet Mi-8 Hip-E attack helicopters in Afghanistan. It is reported to be installed below the cockpit, with the barrel protruding from the "chin" of the helicopter. It is an excellent helicopter weapon, with characteristics similar to those of the 40mm grenade-launching system fitted to many American AH-1 Cobra gunships. It would be particularly effective in suppressing defences around a landing zone. Little is known of this version, although a technical manual and, possibly, samples have reached the West. It is likely that it is fed from a large magazine mounted internally in the helicopter, and has a higher rate of fire than the AGS-17. It may also be used in the turret of BTR-60PB APCs in Afghanistan, replacing the KPVT machine gun.

The standard VOF-2 30mm high-explosive/fragmentation grenade contains A-IX-1 explosive, comprising 94% RDF and 6% wax. This quick-detonating explosive is often used in smaller-calibre HE-Frag and HEAT rounds. Another HE round, the VOG-17, is used by Sandinista and Angolan forces. Weighing 0.35kg each, the VOG-17 and VOG-17M are also filled with A-IX-1.

Other ammunition types include incendiary, training and armour-piercing rounds, the last possibly a HEAT round. The AGS-17's high elevation on its tripod suggests that it also has an anti-helicopter role.

Tactical employment and combat usage

The AGS-17 is a company or battalion-level weapon. A section of two AGS-17s was first added to BTR-60PB-equipped motorised rifle companies in high-readiness divisions. By 1981, BMP-equipped motorised rifle battalions also had AGS-17s. Each section is made up of a sergeant, armed with a Kalashnikov, and the two gun teams, each comprising a pistol-armed gunner who carries the AGS-17 sight and tube, a Kalashnikov-armed assistant gunner who carries the tripod and ammunition, and a Kalashnikov-armed ammunition bearer. The ammunition bearers are not integral to the AGS-17 section, but are provided from the rest of the company. The Sandinista Army, operating dismounted, uses a five-man crew comprising gunner, loader and three carriers.

An AGS-17 section will try to deploy dismounted under cover such as a treeline. To ensure that the grenades have enough clearance, the section will deploy a distance to the rear of the cover that is more than twice the cover's height. The two launchers will normally be placed in a line, 10 to 20m apart, the section leader holding the right end of the line. The ammunition bearers use their Kalashnikovs to provide close-range security.

AGS-17 sections are apparently used as the base of fire in the company's mounted or dismounted advance, and can also be easily lifted in a helicopter.

Soviet units in Afghanistan are reported to have been upgunned with additional AGS-17s. The weapon has been co-located with battlefield surveillance radars for night combat, and its grenades can demolish the sangars (rock breastworks) from which the Afghans engage Soviet troops. Its high elevation makes it useful against positions on higher ground, and its fragmentation shells yield an effective area fire-suppression capability, especially against positions lacking overhead cover.

On the defensive, the Soviets and DRA forces – the latter have a limited number of AGS-17s – dig their grenade launchers into strongpoints. The AGS-17 is considered to be particularly effective in the defence. Before attacking one DRA-manned outpost in the Panjshir Valley, guerrilla leader Ahmad Shah Massoud had to order a 1918-style raid to capture or disable the four AGS-17s in the outpost before the minefields could be gapped and the assault begun.

The Afghan guerrillas have captured substantial numbers of AGS-17s, which they call the *Plomya* in imitation of the weapon's Soviet nickname, and some have been used in action against the Soviets. Maulavi Shafiuallah, the guerrilla leader from the Koh-i-Safi area who was active in the Bagram Airfield sector until his death in action in 1985, used a battery of AGS-17s offensively, principally to fire on truck convoys. The guerrillas usually use them to defend villages or strongholds, however.

The helicopter-mounted version appears to be used in limited numbers in Afghanistan. It is believed to have been issued to KGB Hip-E units outside Afghanistan, and is probably fitted to Air Force Hip-Es throughout the Soviet order of battle.

AGS-17s have been supplied to MPLA and SWAPO forces in Angola, who have used them in action against South African and UNITA forces. UNITA uses numbers of captured AGS-17s. While its weight and bulk are reported to militate against dismounted operations, UNITA appreciates the AGS-17's indirect and area-fire capability in the reduced visibility of bush warfare.

Sandinista forces have received AGS-17s and have used them extensively in action. Nicknamed *la Araña*

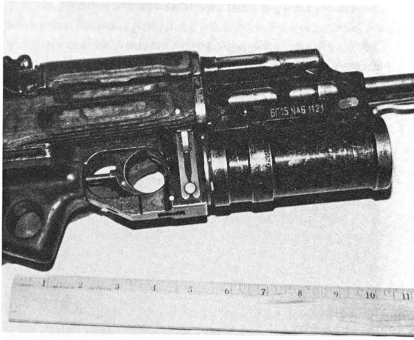
("Spider"), the AGS-17 is a significant source of dismounted firepower for Sandinista troops fighting anti-communist guerrillas.

Engagement sequence

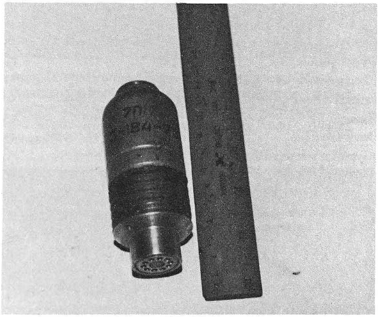
With the magazine seated on the receiver, the cocking handle, mounted on a cable, is pulled smartly about 18in rearwards to cock the trigger. When the handle is released, the recoil spring forces the bolt forward. If the trigger is depressed, a round is chambered and fired from a closed-bolt position. After firing, the bolt travels rearwards, ejecting the spent cartridge case through the bottom of the receiver before halting against the twin return springs. The AGS-17 is a pure blowback weapon, having no locking lugs. A heavy bolt and a hydraulic recoil damper on the left-hand side of the receiver reduce the recoil, but the light tripod leads to poor control and muzzle climb in automatic fire unless the weapon is vehicle-mounted.

The AGS-17's simple feed system makes "stubbed rounds" and low-order in-barrel detonations a possible hazard, though there have so far been no reports of such detonations from Afghanistan.

All sighting is done with the angle-prism telescopic optical sight; there is no auxiliary iron sight. Indirect-fire tables for 1,000-1,730m and direct-fire settings for 50-1,730m are bolted to the receiver. Using the VOF-2 rounds, the maximum-time-of-flight self-destruction mechanism permits airbursts in long-range indirect fire.



BG-15 40mm grenade launcher fitted to an AKS-74, showing stock thumb-hole and separate trigger. A one-foot ruler provides scale. *(David C. Isby)*



A round for a 40mm BG-15 grenade launcher, showing the "tail" containing the propellant. *(David C. Isby)*

BG-15 40mm grenade launcher

Rate of fire	6rpm (max), 3rpm (practical)
Maximum range	420m
Effective range	300m
Weight	1.2kg
Shell weight	0.2kg
Shell burst radius	5m
Fuze	point-detonating

Fitted under the barrel on either AKS-74 5.45mm or AKMS 7.62mm assault rifles, the BG-15 (possible alternative designation BL-15) 40mm grenade launcher is similar in concept, if not in design, to the M203, fitted to two M16 rifles in each US Army rifle squad. The BG-15 is a clip-on system, two clamps attaching its barrel support beneath the barrel of the rifle. It is a short-barrelled weapon, with the trigger mounted directly behind the barrel. A thumb-hole grip for the firing hand is attached: the BG-15 can be fired with the left hand reaching forward while the right hand is on the handgrip.

The calibre of the rifled, muzzle-loading BG-15 – 40mm – is the same as that of the US M79 and M203 rounds, though the Soviet weapon has a different firing system. Whereas the US round resembles a giant shotgun slug, the Soviet 40mm grenade has a perforated "tail" at its base, containing the propelling charge. It fits into a recess at the butt end of the grenade launcher tube. The firing pin then strikes the percussion cap, igniting the propelling charge and launching the grenade complete with the charge container.

The folding, notch-and-bead sight is mounted on the left-hand side of the launcher. It is aligned so that the firer can sight the BG-15 with his left eye in the same way as he sights the rifle with his right.

Combat usage and tactical employment

It is not known how widely the BG-15 is issued within the Soviet Army, though it is certainly being used in Afghanistan. While its designation suggests that it entered service in the mid-1970s, none of those captured show dates of manufacture before 1983. The tactical employment of the BG-15 can therefore only be conclusively established in relation to its use in Afghanistan, which may not reflect how it would be used in Europe. The BG-15 is used for both direct and indirect fire in Afghanistan. Guerrillas report it being used "like the British two-inch mortar", putting down accurate high-explosive fire in the indirect role; there are however no reports of its being used with smoke or illumination rounds.

The BG-15 has been in use for more than two years in Afghanistan. Squads of eight to ten infantrymen are frequently equipped with one or two. Like most Soviet grenade weapons, it is used against Afghan sangars. The 40mm grenade also apparently makes a good contact-breaker in an ambush.

Engagement sequence

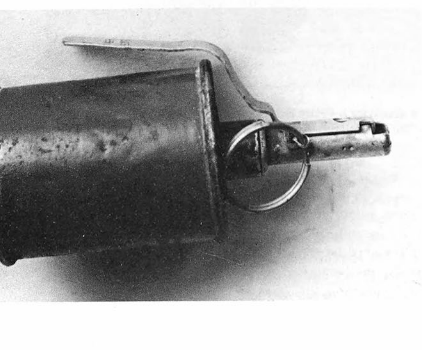
The BG-15 is designed to be fired from the shoulder. For indirect fire, the notch-and-bead sight is clicked to the range once this has been established with the rifle sights. The sight bears the white markings "2" and "3", for 200m and 300m, the latter the launcher's maximum effective range. There is also a red "42" at a still higher elevation which may be that for maximum range. Below 200m the BG-15 is probably best fired with the rifle sights.

The BG-15 probably has a strong recoil. Afghans have seen it sometimes fired from the ground rather than the shoulder, in much the same way as the old US grenade launcher on the M1 and M14 rifles.

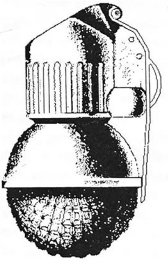
Grenades

Grenade	F1	RG-42	RGD-5	RKG-3M	RDG-1	RGO	RGN
Type	HE	HE	HE	AT	smoke	HE	HE
Diameter	55mm	54mm	57mm	55mm	46mm	–	–
Length	124mm	127mm	114mm	362mm	250mm	–	–
Type of charge	HE	HE	HE	HEAT	smoke	HE	HE
Charge weight	60g	118g	110g	567g	–	114g	92g
Fuze (delay)	3–4sec	3–4sec	3–4sec	contact	5sec	3.3–4.3sec	3.3–4.3sec
Range	34m	40m	45m	15–20m	–	25–45m	20–40m
Burst radius	15–20m	15–20m	15–20m	impact	20 × 8m	100m	–
Armour penetration	–	–	–	125mm	–	–	–

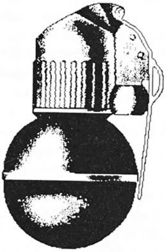
RG-42 offensive HE grenade. (*US Marine Corps*)



Right RKG-3M HEAT grenade, still used by Communist forces in Afghanistan. *(David C. Isby)*



Left RGO grenade. *(Joe Bermudez and Ken Kraft)*



Right RGN grenade. *(Joe Bermudez and Ken Kraft)*

Soviet riflemen carry both fragmentation and anti-tank grenades. The fragmentation grenades include the wartime F-1 and RG-42 types and the modern, more compact RGD-5. The standard anti-tank grenade is the RKG-3M. This uses a stabilising drogue to ensure the proper angle of impact for its HEAT warhead, and although it is relatively ineffective and short-ranged (it must be tossed underhand or dropped from a window), it apparently remains in service. The RDG-1 and -2 smoke grenades emit a dense white smoke. The RDG-2 can cover an area 20m long and 8m wide, burning for 90sec.

A CS gas grenade weighs 250g, of which 170g is gas.

The F1 often produces 3-6 large pieces. As with the 1916 Mills bomb, the larger pieces can travel 200m, so the F1 must be thrown from under cover. It makes a popping sound when the spoon is let go which can possibly alert the target. The RG-42 is primarily a defensive grenade, also thrown from under cover. The RGD series can be put to both offensive and defensive use. The Soviets have introduced two new grenades, the RGN (offensive) and the RGO (defensive), which may replace the older designs.

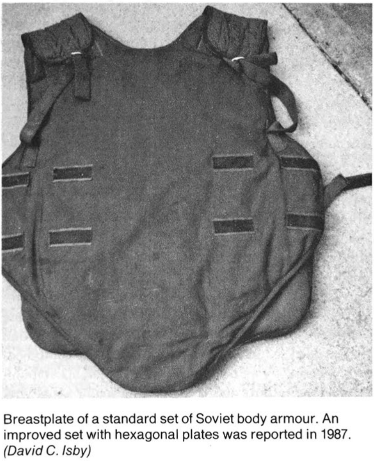
Body armour

The standard Soviet body armour comprises a light (4kg) set of breast and back plates. The material is an aluminium alloy encased in fabric. Mainly effective against shell fragments and pistol rounds, it has been extensively used in Afghanistan, starting around 1983, and by 1986 was standard issue in Eastern Europe. It is worn during dismounted operations as well as by the passengers and crew of BMPs and BMDs (in which there is a danger of spalling following hits by machine gun fire) and Hip helicopters (which lack armour for airmobile assaults).

Two heavier sets of breast and back plates, one of steel with extensions protecting the kidneys, is used in Afghanistan by mounted personnel, especially truck drivers. Sappers on mine-clearance work also wear greaves and a plexiglass face shield attached to the helmet.

A vest-type device containing air-sealed cotton packets provides both flotation and limited ballistic protection.

Jacket with fibre-filled packets in its lining, giving both flotation and ballistic protection, especially if the garment is worn under metal armour. This example was captured from a Soviet adviser by South African forces in Angola. *(Peter Kokalis)*



Breastplate of a standard set of Soviet body armour. An improved set with hexagonal plates was reported in 1987. *(David C. Isby)*

Chapter Seventeen
Helicopters

"Helicopters, equipped with diverse types of modern weapons and capable of destroying ground targets, have become an indispensable part of modern combat."

COL M. KIRYUKHIN

The Soviet Army and the helicopter

Following limited use of autogyros in the 1930s and the Second World War, the Soviets developed an interest in helicopters and their military applications in the late 1940s. But it was not until the 1970s that helicopters emerged as a key element of army operations.

The roles of Soviet Army helicopters include attack and transport, although no clear distinction is made between the two. While all Army helicopter units have a reconnaissance mission to a greater or lesser degree, they lack specialised scout designs. There are however a wide range of specialised helicopter missions – aerial command and relay, communications and radar jamming, mine-laying, laying of smokescreens, chemical and nuclear radiation monitoring, and forward air control – in addition to the main functions of close air support and tactical air mobility.

While front has been the level of Army/Air Force integration since the Second World War, in the late 1970s the Soviets decentralised some aviation assets, mainly helicopters, to army and even division-level command while centralising others, mainly long-range strike aircraft, under TVD command. This has made possible the disbandment of the air army – one of which was normally subordinate to each front – as an independent level of command, its function being taken over by the front deputy commander for aviation. The divisional helicopter squadron (attached to divisions in GSFG, Afghanistan and other high-readiness areas) and army-level helicopter regiments are expected to permit air power to be used more responsively. It seems that this part of the reorganisation was intended to increase the integration of the combined-arms offensive by reducing close support and accompaniment response times and by locating a senior air adviser with the ground force commander.

There is no Soviet Army aviation on the Anglo-American model, all helicopters being part of the Air Force's Frontal Aviation or Transport Aviation (VTA). Despite efforts in the 1970s to increase the combined-arms effectiveness of helicopters, it appears that the integration of attack helicopters with ground forces may still present some problems. In Afghanistan, however, Soviet Army sub-units have apparently co-operated closely with attack helicopters, although the relatively low intensity of operations there probably allows ground forces to use Air Force liaison teams on a scale that would not be possible in a general war. In theory the Soviets do not recognise any great distinction between helicopters used by Aeroflot, the Army and the Air Force. As Aeroflot helicopters are owned by the state and their crews are invariably reservists, they can be counted as practically a part of the Air Force. No great weight should be placed on the apparent ownership of Soviet helicopters.

Afghanistan has been one of the prime stimuli for change in the Soviet rotary-wing force. The helicopter is the most important single system, both for weapons delivery and for transportation, in modern counter-insurgency combat. The helicopter force has made much of the Soviet campaign in Afghanistan possible. By the mid-1980s the helicopter was not a peripheral part of the Soviet way of war, but as central as tanks or artillery.

The Soviets are placing a great deal of importance on the role of the helicopter in deep operations, in both conventional and nuclear conditions (Soviet helicopter aircrew are reported to have worn NBC suits in flight). They will be used to insert troops in the operational and tactical depths of the enemy defence, to provide priority resupply to forward troops and, perhaps most significantly, to "provide the most effective support and protection for operational manoeuvre groups and raiding detachments acting away from the main forces", in the form of ground support, reconnaissance and target acquisition.

It is however accepted that there are limitations on the use of helicopters in this way, not least the difficulties of forward basing. Operational manoeuvre groups and raiding detachments may operate at distances exceeding the maximum combat radius of helicopters. There may be

heavy losses from ground air defences during the repeated flights between the operational area and bases in the first echelon of the main forces. Current Soviet doctrine states that "helicopters in support of troops engaged in raiding and manoeuvring activities can only be employed, therefore, when these troops are operating at short distances away from the main forces and when there is a very considerable suppression of the enemy anti-air defence and troops in general." But if the Soviets want operations in depth, particularly in a conventional environment, they will have to make large-scale use of helicopters. Air assault and airmobile brigades, for instance, may be inserted by helicopter after the necessary air defence suppression has been carried out. These very large lifts (the Soviets have criticised the US use of helicopters in Vietnam as too tactical, representing a failure to concentrate a powerful asset) could be part of the air operation, or part of operations in the enemy's rear, whether independent or in conjunction with OMGs.

Although the GZST-4-1250 mobile system – said to be capable of being set up by four soldiers in 35 min – can refuel four helicopters simultaneously, Soviet attack helicopter planning does not seem to place as much emphasis on forward-area refuelling and re-arming points (FARRPS) as does the US Army. In Afghanistan, for instance, Soviet helicopters normally operate from permanent airfields. However, it is possible that, with a refuelling system and a maintenance team mounted in trucks, helicopter units could travel with an OMG. The requirement that Halo be capable of operating away from its main base for a week may point to a desire for such capabilities.

The emergence of the Havoc and Hokum combat helicopters in the mid-1980s means that the Soviets now have rotary-wing counters to all the different systems threatening their main battle tanks: Havoc is optimised for use against tanks, Hokum against ATGM-firing helicopters, and Hind against a variety of weapons, including ground ATGMs. New weapons, including advanced ATGMs, will be developed for these aircraft: the Soviets are expected to field a 10km-range ATGM for helicopters by the 1990s.

In 1984 the Soviet military was estimated to operate 300 Mi-1s, 1,200 Mi-2s, 300 Mi-4s, 450 Mi-6s, 4,500 Mi-8/17s, 30 Mi-10s, 1,200 Mi-24s, 30 Mi-26s and a small number of pre-production Mi-28s. In 1986 total attack helicopter strength was put at about 1,300. Aeroflot had about 2,000 helicopters, mainly Hips but also including Hooks and Halos.

There are five state aviation factories producing Soviet Air Force helicopters: Zaporozhe (Mil design bureau headquarters), Arsenyev-Progress Works (producing Hind), Rostov (Hind), Kazan (Hip) and Ulan Ude (Hip). WSK-Swidnik in Poland is responsible for Hoplite production. In 1983-84 annual production was about 250 Hinds, 425-450 Hips and 25 Halos, of which 25% were exported and 10% went to civil users. Havoc will be produced by the Hind factories.

Soviet helicopter pilots go from flying training to operational training with their wings and 200-250 flying hours to their credit. The operational training unit turns them over to the squadron as rated pilots. The lowest rating, pilot third class, implies limited combat, day-only capability. Second-class pilots are cleared for combat and all-weather flying, first-class for combat and all conditions down to night bad weather. The top 5-10% of each unit earns the coveted "sniper" rating. Pilots fly 80-100hr a year, plus several times that in the simulator. Pilot retention rate is reported to be high.

Pilots normally serve one-year tours in Afghanistan – counting as three years for pension and, it is reported, seniority purposes – and may carry out up to 500–600 combat missions in 400 flying hours.

Helicopter lift and assault

Although demonstrations were carried out as early as 1956, heliborne assaults were first seen in the 1967 Dnepr manoeuvres, involving over 100 Hounds and Hooks. Since then the practice has played an increasingly important part in Soviet operations.

Heliborne forces are used to seize key operational and tactical objectives in the offensive, and as operational mobile reserves on the defensive. In the former role they would work with attack helicopter units and ground units with the same missions, forming air-ground assault groups intended to penetrate defences, primarily through a ready breach or gap. They would also be called on to defeat enemy tactical reserves; destroy nuclear delivery means and headquarters, and other priority targets; seize key terrain; block enemy movement; and pursue defeated forces. These operations would often be mounted in conjunction with airborne *desants*, *reydy*, forward detachments and amphibious operations.

Seizing river crossing sites and isolating them from enemy reserve units by emplacing blocking forces is seen as an important mission of heliborne forward detachments. Egyptian heliborne units operated in this way during the Suez Canal crossing in 1973. These forces were heavily armed with suitcase Sagger ATGMs, RPG-7s and SA-7s. Soviet detachments operating in a similar role would probably also have many anti-tank weapons for use against enemy armoured reserves. Similarly, heliborne forces will often be used to isolate beachheads from counterattacks in amphibious operations.

Heliborne assaults are planned at division (tactical) or higher (operational) level. How far the assaulting units will be placed behind the enemy front lines depends on the situation and mission. In a tactical assault, such as one carried out in conjunction with an attack against a river

line, the landing zone (LZ) may be 1-10km behind enemy positions, within range of supporting artillery. In conventional operations a battalion may be inserted 35-50km or more ahead of the advancing forces, while in nuclear operations this distance can be as much as 100km. The increased combat power of Soviet heli-lifted forces now apparently makes it possible to project battalion-sized forces not 20 or 30km behind the FEBA, but as much as 100km. This would certainly increase the Soviet Army's deep reach.

An air assault or airmobile brigade can be committed in pursuit of operational-level objectives, although this would impose a heavy burden on the helicopter forces. A brigade-sized force would be more capable of independent operations, although it would still necessarily be relatively light. The Soviets realise that heliborne battalions either have to link up with the main force or be withdrawn relatively quickly; they are thus most likely to be used in mobile battle conditions.

The air assault or motorised rifle battalion appears to be the standard tactical force for heliborne attacks – reports from Afghanistan seem to bear this out – and may be reinforced by engineers, NBC reconnaissance teams, air and artillery liaison parties and, if enough heavy-lift helicopters are available, a 122mm artillery battery. The battalion may be lifted without its APCs or BMDs, though light trucks may be used in their place. Such a force could be lifted by 30 Mi-4s and five Mi-6s (more Mi-6s would be required for heavy equipment), or 20+ Mi-8s, which can lift light trucks and BRDMs. The force would be intended to hold until relieved for 24 or possibly 48 hours despite its lack of mobility and heavy weapons.

Heliborne operations are mounted from a pickup zone located 20km or more behind the front line, and often take place at night. The assault force is assigned a route that minimises exposure to enemy air-defence weapons. Defence suppression is provided by artillery, fixed-wing aircraft or nuclear weapons. A heliborne command post normally co-ordinates the operation and the use of supporting fixed-wing aircraft and artillery. Other helicopters or fixed-wing aircraft can be provided for ECM support and communications relay. Before a battalion-size force flies in, an advance detachment may be inserted into the LZ by Hip to secure it against counterattacks and short-range fire. The detachment includes an Air Force guide party, which will transmit information to the main force and direct its approach; alternatively, the Air Force team can remain heliborne.

In an assault the transport helicopters will fly at 50-100m altitude, taking advantage of cover from terrain, and will be escorted by Hinds ahead and on the flanks, with a top cover of fighters. During the fly-in, the transport helicopters may fly in finger-four formation. In Afghanistan, when flying into valleys, they have formed a column of pairs. In 1987 Soviet helicopters were seen flying in at no more than 10m altitude.

The LZ should have been cleared of enemy units by the pre-assault suppression and the advance detachment. If not, the Hinds and the armament fitted to the transport helicopters for defence suppression and self-defence will be used to complete the clearance, although taking transport helicopters into a "hot" LZ is likely to result in heavy losses. The Soviets hope to unload (or load) a battalion in 10-15min. An LZ for a battalion lift can measure 200m by 75m, allowing two columns of helicopters to touch down simultaneously. Alternative, multiple or dummy LZs will be designated and used as required.

Once the battalion has formed up on the ground, it will move out for the objective. SA-7/14 SAM launcher teams, the last element to load at the pick-up zone, will be the first out at the LZ. Hinds or Hip-Es will remain in the area as long as possible to provide close air support.

Heliborne assaults may follow the use of non-persistent chemical agents such as hydrogen cyanide to suppress opposition at the landing zone; they may also follow nuclear strikes by as little as 15-20min. In addition to the assault role, helicopters are also used to follow up ground advances, bringing forces into secured areas to consolidate objectives, and to allow advancing units to bypass obstacles on the ground.

While Soviet heliborne assault forces have many human problems in common with the attack helicopter units – lack of initiative, uneven crew training – the large number of Afghanistan veterans now available throughout the force must be having a beneficial effect.

Helicopters can be used to drop paratroopers when conditions are unsuitable for assault landings. In Exercise Danube 84, 36 helicopters dropped troops from 300m altitude on to an airfield, which was seized to allow fixed-wing transports to bring in follow-on forces. There have also been reports of drops from helicopters in Afghanistan.

The Soviet supply requirement far exceeds helicopter capability, and rotary-wing transports will be used primarily to move high-priority items quickly and to resupply forces beyond the reach of wheeled transport, particularly heliborne units and *desants*. The extensive use of transport helicopters in Ethiopia and Afghanistan shows the importance that the Soviets attach to this new aid to the mobility of firepower, troops and supplies. Transport helicopters are vital to military operations in difficult terrain: in Ethiopia helicopters flew supplies and transported Cuban and Ethiopian troops over otherwise impassable country.

Attack helicopters

For many years attack missions were performed by armed versions of standard transport helicopters such as the Mi-2, Mi-4 and, especially, the Mi-8s. But, starting in 1972, these

types have been supplemented by the purpose-built Mi-24 Hind series, now the main Soviet attack helicopters, and will be joined in the late 1980s by the Mi-28 Havoc and Kamov Hokum. The current strong emphasis on the attack helicopter is clearly one of the responses to the challenge to the Soviet tactical system represented by Western advanced technology.

The helicopter is seen as very much a part of a combined-arms force, exploiting terrain and making optimum use of its weapons systems to minimise vulnerability. While nuclear delivery means, headquarters and communications systems will always be their top-priority targets, most of their time will be devoted to the destruction or suppression of enemy tanks, anti-tank weapons (especially ATGMs) and helicopters, the weapons seen as posing the greatest threat to combined-arms mechanised forces.

The emerging mix of attack helicopter designs reflects this need to defeat a broad range of targets. While Hokum appears to be specifically designed for the air-to-air mission, both Havoc and Hind also have an anti-helicopter capability. Hind-F is possibly optimised for air-to-air combat, equipped with a radar gunsight and SA-7/14 infra-red-homing missiles.

Attack helicopter missions, like those of artillery, comprise: counter-preparation (which may include defeating enemy helicopters threatening Soviet ground units in their assembly areas or pre-battle formations); preparatory (pre-planned missions carried out before an attack); close support (carried out during an attack, and often called for by commanders on the ground or in airborne command posts rather than being pre-planned); and air accompaniment (into the depths of the defence, striking targets acquired by ground headquarters or by helicopters engaged in armed reconnaissance).

Attack helicopters support heliborne assaults, *desants* and other special operations, lending their firepower to units that lack heavy weapons. The Soviets emphasise deception and surprise in offensive helicopter tactics, the techniques including terrain masking, decoy flights, and simultaneous and successive attacks on, if required, multiple points. Army-level attack helicopter regiments can also serve as mobile anti-tank reserves in both attack and defence.

The Soviets appear to rely almost exclusively on helicopters for what in Anglo-American practice is called close air support missions. Fighter-bombers, freed to strike in the enemy's operational depths by the helicopters' assumption of many tactical missions, concentrate on targets more than 30km from Soviet forces, especially fixed, pre-located targets. The Soviets will try to co-ordinate the use of attack helicopters with artillery (especially against air-defence weapons) and fixed-wing aircraft, which will also guard the helicopters against enemy fighters. To facilitate co-ordination with artillery, some helicopter crews are trained to adjust artillery fire; this also permits more responsive target acquisition. Helicopters can also attack the flanks and rear of targets frontally engaged by artillery.

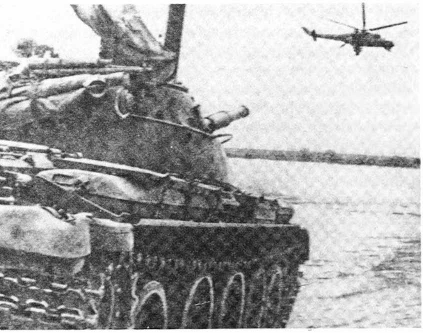
Helicopters will give close air support to the main ground forces, supplementing and closely integrated with artillery, and concentrating firepower. This was observed in Exercise Druzhba 84 in Czechoslovakia, in which the helicopters operated against defensive strongpoints and counterattacks. In Exercise Nieman, artillery struck the centre of enemy concentrations as helicopters worked the flanks. In the pursuit, attack helicopters will try to ambush retreating forces while artillery will be used to channel the enemy into the target areas.

The recent rapid expansion of the Soviet helicopter force may well have been accompanied by growing pains, offset to some degree by combat lessons from Afghanistan. There have been problems of co-ordination between ground troops and helicopters in Afghanistan, resulting, for instance, in helicopters destroying a target already knocked out by ground units, or not engaging the proper target at all.

Rather than US-style interdiction, the Soviets stress "air accompaniment", massing aviation assets decisively on the main axes of attack and throughout the operational depths of the defence. In this application attack helicopters are seen as a highly responsive source of firepower: Hind, for instance, may be able to provide tactical units with on-call air support. Major-General M. Belov, the leading theorist on helicopter warfare, has stated that the success of offensives is doubtful "unless mass use is made of helicopters."

US helicopters, using tactics of minimal exposure and stand-off ATGM fire made possible by targeting assistance from light observation helicopters, were shown in the Ansbach tests of the 1970s to be capable of inflicting an 18:1 kill ratio on Soviet-type tank units despite dense air defences. The thought of what NATO helicopters could do to a second-echelon tank division caught moving to the front cannot be reassuring to Soviet planners. As a result anti-helicopter capability is now emphasised throughout the Soviet forces, which may also be acquiring the world's first anti-helicopter helicopter. This latter is a logical step: US tests have shown that jet fighters have a difficult time killing helicopters, and that the job is probably best done by another helicopter.

As well as providing close air support, attack helicopters can engage ground targets in the same way as fighter-bombers, and can help find targets for other weapons systems. Again like fighter-bombers, helicopters will be used for armed reconnaissance, especially when visibility is poor or the enemy's flanks are unprotected. They will operate in flights of two, three or four, on the enemy side of the FEBA and at low altitude and high speed. They will pop up to observe, maximum exposure time being one



The Soviets are concerned about the helicopter threat to tanks. The crew of this T-62 will have been trained to use both main gun and machine guns against helicopters, while other T-62s carry turret-mounted canisters which may contain surface-to-air missiles.

minute. The decision on whether to attack a target of opportunity is made by the flight commander. The Soviets will normally use sniper-rated crews for these missions. Helicopters will be used for quick-reaction reconnaissance in fluid battle and for engineer reconnaissance. In five or six hours one Hip can cover two routes for a day's march. Soviet helicopters can be used to spray NBC decontaminants; Hind-Gs and Halos were used for this purpose after the Chernobyl nuclear accident in 1986.

Soviet helicopter tactics place a heavy burden on the Air Force guides and on the crews themselves. Each flight commander, working with ground command posts, is responsible for guiding his formation through complex tactical manoeuvres. It would appear that Soviet attack helicopter tactics are not as flexible as those of Western armies, just as Soviet air combat tactics are more rigid than those used in the West. The Air Force guide does however permit more crew initiative than does the fighter GCI controller.

Soviet attack helicopters normally fly in flights of four or six, with pairs or groups of three acting in mutual support. Normally two or more flights will work together, making co-ordinated attacks from different directions or, if "stepped up" like flights of fighters, with a high flight acting as a diversion and drawing fire while the low flights go into the attack. Pairs may use similar tactics, one hovering at 100m to spot targets and draw fire while the other stays at low altitude to attack.

Starting in about mid-1983, five-ship flights have also been seen using similar tactics, while three-ship flights, possibly the new standard, comprise two helicopters tasked with search and attack, with a third covering them and looking out for air and ground threats. The two search and attack helicopters would fly like a standard element, with the wingman slightly behind and higher than the flight commander. Four-ship flights remain standard.

Hind tactics are optimised to take advantage of the type's high speed; its low-altitude manoeuvrability is less than that of Western helicopters. Air-to-air tactics are likely to be based on those of fighter aircraft.

Soviet attack helicopter flights operate in trail or line (75–90m between aircraft), echelon left or right (75–90m between aircraft and at a 30° angle), or staggered trail (75–90m between aircraft, 200m between pairs, wingmen 5–10m above and 30° offset from leaders). Wingmen are always on the outside of turns and follow all the actions of the leader.

The Air Force guide will establish an initial point about 15km behind the FEBA, and will designate attack positions for each target. He will then authorise flights to move from the initial point to the attack positions and strike the target. He is also responsible for marking friendly troop locations.

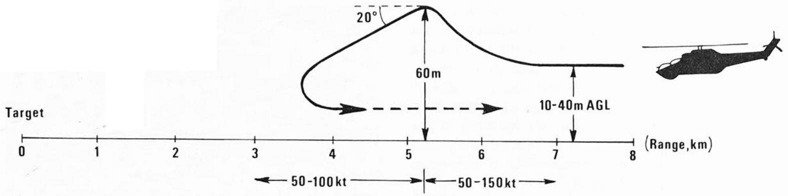
Like their US counterparts, Soviet attack helicopters will use woods and ridges for concealment before carrying out pop-up attacks, rising from 5-10m altitude to 20-100m and firing at targets 2,000-3,000m away, a procedure that should take 20-30sec. If terrain permits, they will also use ground-level concealed firing positions. Two helicopter elements and four-helicopter flights will shift into line-abreast for weapons firing.

When the target requires, or when opposition is light, Hinds will make diving attacks from about 1,000m altitude, using machine guns, rockets and even bombs in an attack pattern similar to that of US gunships in Vietnam, which would break away at the end of the firing pass into a sharp evasive turn or terrain-hugging flight. Hinds have been observed using these tactics when bombing villages in Afghanistan.

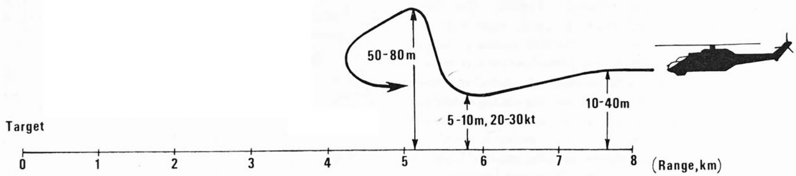
Soviet attack helicopters make either "running fire" or "hover fire" attacks. In running fire, the helicopter begins the attack at 50-150kt (50-100kt for ATGMs) and 10-40m above ground level in contour-following flight.

It then pops up to no more than 60m above ground level at a range which depends on the weapons being used – 3-5.5km for ATGMs, 1.5km for 57mm rockets – and fires at a dive angle not exceeding 20°. It then turns, diving away at low altitude. Hinds will normally break away from firing passes at about 1,500m range, reducing vulnerability but also accuracy.

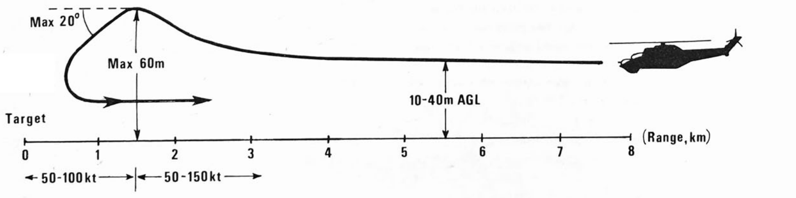
Running fire is more commonly used than the recently introduced hover fire. In a hover-fire attack, an ATGM-armed Hind uses contour flight and terrain masking to close with the target, entering the profile at 50-150kt, 10-40m above ground level. On reaching the attack point it holds at an altitude of 5-10m and a speed of



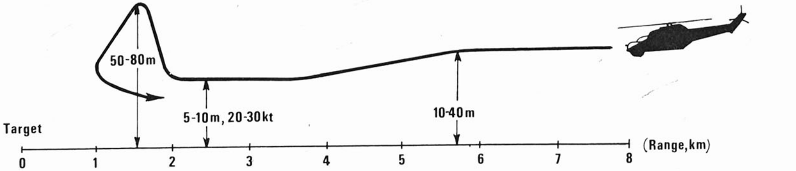
Hind running-fire attack with Spiral ATGM. Profile with the Swatter ATGM is similar.



Hind hover-fire attack with Spiral ATGM.



Hind running-fire attack with 57mm rockets.



Hind hover-fire attack with 57mm rockets. Fully loaded Hinds cannot hover.

and a speed of 20-30kt before popping up to the minimum altitude needed to acquire the target. It then fires at a speed ranging from the hover to 20-30kt. The ATGM is fired at maximum range, 57mm rockets at 1.5km; the helicopter then "pops down" behind covering terrain.

Whatever pattern is used, attacks normally begin with high-speed, low-level run-ins from the initial point to the attack point, where the Air Force guide issues final directions. After firing, the helicopters exit the area at low altitude and the Air Force guide directs them to another attack or initial point, or a forward arming and refuelling point.

If required, successive flights will attack to keep a target under constant fire. Because each helicopter will normally fire only one or two missiles in an ATGM attack, the same helicopters will attack repeatedly after breaking away from the pattern until all their missiles are expended.

Attack helicopters have been used in conjunction with fighter-bombers in Afghanistan and in exercises in Eastern Europe. To ensure separation, there is a minimum time interval between fixed and rotary-wing strikes, while the fighter-bombers do not go below 300m altitude nor the helicopters above 200m.

Soviet writings have shown an awareness of both the effectiveness and the limitations of the attack helicopter. Like anything else on the modern battlefield, an attack helicopter that can be seen can also be killed. But the Soviets know that fewer than 40% of the exposures of attack helicopters are detected by enemy troops, and fewer than 33% by fixed-wing aircraft. In addition the lethality of the attack helicopter's weaponry has increased, making judiciously timed and placed exposure well worth the risk.

Helicopters in Afghanistan

The helicopter is the most important single Soviet weapon in the war in Afghanistan. The Afghans hate and fear helicopters – especially the Mi-24 Hind attack helicopter – more than anything else.

The DRA forces have had Soviet helicopters since the 1960s, and this small force started to take losses as the war spread during 1978. The suppression of the Herat uprising of April 1979 brought the first Soviet combat forces to Afghanistan in the form of an independent attack squadron of 12 Hind-As. These were soon committed to action and were followed by more throughout 1979; until late in the year these aircraft were all repainted in DRA markings. There were already over 100 Soviet helicopters in-country at the time of the invasion in December 1979. By 1986-87 there were about 275 helicopters based in Afghanistan and another 100 operating from the USSR.

Throughout the war Hinds have been used for close air support, bombing villages, convoy escort, patrol and, especially in 1985-86, interdiction. Flying by day and night – although night missions were rare before 1983 and only became standard in 1984-85 – the Hinds are armed with undernose 12.7mm machine guns; 57mm and 80mm rocket pods; HE, white phosphorus and incendiary bombs; "liquid fire" delayed-action incendiary canisters; cluster

Hind escorts a Soviet troop column somewhere in Afghanistan in a display of air-ground co-operation. The element in the background is keeping closer than standard formation. Major troop movement and convoys have had Hind escorts since 1984. *(Jamiat-e-Islami Afghanistan)*

bomb units; anti-tank guided missiles; and chemical canisters. The same range of ordnance is used by other helicopters and fixed-wing aircraft.

The Hind units have had to adapt to an increase in the effectiveness of Afghan air defences since 1984, and especially in 1986–88. There has also been a disparity between Hind performance on paper and what the units have proved to be capable of in action, the Hind force being relatively new and lacking combat experience.

The Hinds – both Soviet and DRA-marked aircraft – that first went into action in Afghanistan in 1979-80 used tactics that suggested little respect for the opposition. They would stop and engage Afghans at low speeds and altitudes. Attacks with machine guns, 57mm rockets and 250kg cluster and HE bombs would normally be made in a dive attack from 1,000m altitude, followed by a breakaway into a sharp evasive turn or terrain-hugging flight and manoeuvres to reposition for another pass. These tactics would be employed by groups of as many as four to eight Hinds in a circular pattern similar to the American Vietnam "wagonwheel" or the "circle of death" used by Soviet Il-2 *Shturmoviki* in the Second World War. However, the unvarying nature of these patterns gave the Afghans a set respite after each attack, allowing them to scramble to another position.

All this had begun to change by late 1980. Scout helicopters – Hips or Hinds rather than lighter types – were used to acquire targets for both attack helicopters and fixed-wing aircraft. The scout ship, with the formation commander aboard – now often stays high, out of range of the target but with a better field of visibility, and directs the attack helicopters. It thus operates more as a "master bomber" than as a US-style light scout, although smoke rockets are used to mark targets in the American manner. DRA helicopter units appear to have adopted the same tactics, using Mi-4 Hounds. Similar tactics were demonstrated in the Zapad-81 manoeuvres, and this may well be an example of tactics developed in Afghanistan being transplanted to European conditions.

More sophisticated than the master-bomber Hips and Hinds are the airborne command post Hooks that have taken part in combined-arms offensives in 1984-86. Other helicopters are used for radio relay during offensives.

Even in the early stages of the war, the Soviets used substantial formations of Hinds, with attacks by several flights of four being seen in the Panjshir Valley offensives of 1982. While the normal Hind attack force comprises four to 12 aircraft, formations of up to 16, flying like fighter aircraft in staggered "Kuban Steps" of finger-four flights, have been seen carrying out interdiction attacks on supply convoys and staging areas. Three-ship elements of Hinds have been used in Afghanistan, though four is standard.

Until 1984-86 the Hind units displayed many shortcomings. Responsiveness, integration with the ground forces, and tactical flexibility were all frequently lacking. The Soviet press has featured accounts of Hind units flying into known concentrations of anti-aircraft weapons, failing to take evasive action when fired on, and attacking positions that the enemy had clearly vacated. Targets of opportunity were seldom attacked. Since 1984, while attacks are still often not pressed home at low altitude, a new responsiveness and aggressiveness has been seen. Some Resistance sources say that this dates from the relief of Urgun in January 1984.

The acquisition of SA-7 man-portable SAMs by the Resistance and the resulting heavy losses of helicopters led to a change in Hind tactics. By 1981 Hind units were occasionally using contour flight. By 1983 Hinds and Hips were being seen ejecting flares from automatic dispensing systems. While these have reduced vulnerability to SA-7s, they do not confer immunity, and helicopters have been lost even while dropping flares. Other countermeasures include the new Hot Brick infra-red jammer and large shrouding systems fitted to exhausts to cut down the heat emissions that attract infra-red missiles.

Hind-A had been withdrawn from Soviet service in Afghanistan by 1983. At about the same time, the DRA Air Force acquired increased numbers of export-model Mi-25 Hind-Ds. The improved crew protection and armoured belly of the D and E models have made them more combat-worthy.

By 1983, apparently in response to the increased capability of the Resistance, the Soviets had introduced new Hind attack patterns. Starting 7,000-8,000m away from the target, Hinds now run in at low altitude, pulling up to 20-100m altitude to fire, usually starting at maximum range. They generally will not close within 1,500m of the target if it is defended by heavy machine guns. Despite their armour protection and the general weakness of Resistance air defences, Hinds often attack from high altitude.

In 1984 Soviet helicopters would make spiralling approaches to beleaguered outposts. By 1985 they were having to do this at Kabul as well. To further reduce exposure, ferry missions are flown at maximum ceiling. All of this has led to greater wear on airframes and systems, yielding increased operational attrition. 2.0-2.2g pull-ups by attacking Hinds are considered excessive, not so much for fatigue reasons as because of the danger of the rotor blades striking the fuselage.

The arrival of Stinger and Blowpipe SAMs in Afghanistan in 1986–87 introduced an even more lethal threat. Although the Soviets had had over a year before the weapons went into action to prepare countermeasures, the chosen combination of flares, suppressors, active jammers and minimal-exposure tactics does not seem to have been very successful. In 1987 a kill ratio of 68% was being claimed for Stinger, along with an overall Soviet loss rate of 1.2 aircraft per day. This was reduced only by limiting operations and missions, but it remains that even small,

This Hind-D or E was shot down in the Panjshir IV offensive in August–September 1981. Despite the type's armour protection, it is estimated that about a third of the Soviet helicopters lost in Afghanistan have been Hinds. Even if burnt out, Hind wreckage is identifiable by the titanium armour that is left. *(Jamiat-e-Islami Afghanistan)*

hand-held Western SAMs with well-known capabilities are able to inflict heavy losses on Soviet helicopters. In 1987 the Stinger threat often obliged Soviet helicopters to attack at night or from low altitude, with the latter leading to increased losses to Resistance anti-aircraft fire.

The concept of mutual support is central to Soviet helicopter operations. As a result, Hinds never attack singly. Some attack patterns remained in use from the start of the war to 1985-86. These include the sending of one helicopter in at high altitude to draw fire while the wingman remains low, behind a ridge line, ready to attack anyone opening fire.

Helicopters are intended to operate as part of a combined-arms force. In Afghanistan they are used to help secure the roads snaking through mountain valleys and passes for the passage of motor convoys by detecting and attacking any enemy forces in ambush position on the overlooking heights. Outpost detachments are landed by helicopter to secure the heights until the column passes and are then lifted out. This practice has been seen in Soviet combined-arms offensives since 1981, with battalion-sized forces being used since 1982. Other battalion-sized forces have been inserted as airborne forward detachments or "stop groups". Tribal militia – border Pathan tribes bought with Moscow gold – are reported to have been inserted by helicopters to secure high ground for Soviet forces in 1985 offensives.

Minelaying is one of the most important elements of Soviet helicopter tactics in Afghanistan. Early in the war helicopters were used to lay surface mines around Soviet perimeters. The offensive use of PFM-1 "butterfly" mines, dropped throughout Resistance-controlled areas, is an important interdiction method, helping to destroy the agricultural infrastructure and, in conjunction with Soviet ground forces, cordon off villages being swept.

Convoy escort is an important Hind mission in Afghanistan. Up to 1980 Soviet convoys tended to be large enough to attract guerrilla attention but too small to defend themselves adequately, and suffered heavily as a consequence. Since then the Soviets have consolidated their convoys into large forces of several hundred vehicles, running them on major routes and providing strong surface and air escorts. By 1984 almost all major Soviet road convoys had helicopter escort, as do major troop columns during offensives.

Since then, on the main routes, convoys normally have two or four Hinds overhead or, frequently, moving in front of the convoy and applying reconnaissance by fire to suspected ambush positions. Convoys are also supported by helicopters on alert at nearby airfields; Air Force personnel accompanying the convoys in modified APCs – replacing the more vulnerable jeeps used early in the war – have direct links with these airfields.

The Soviet use of preparatory air strikes before even small-scale ground operations has been applied to convoys as well, with the aircraft striking about 6km ahead of the convoy and starting over an hour before its arrival. The Afghans have however learned to wait well back until the convoy is almost level with the chosen ambush site before moving into position.

Soviet convoys hit by an ambush call back the escorting Hinds from their preparation and reconnaissance-by-fire

tasks for direct support, using rockets and machine guns against the roadsides. If there are enough aircraft available, a figure-of-eight pattern with about six Hinds is established. By 1985 convoy ambushes could become costly indeed to the Resistance, and one of the aims behind the use of the Stinger SAMs supplied in 1986–87 is to restore the effectiveness of such actions.

The use of a command and control helicopter has also been seen in some of these convoy escort battles. At least one Hind, probably the flight commander, remains high to direct the attacks and handle signals relay. Difficult VHF transmission in much of Afghanistan's mountainous terrain has made the use of radio relay aircraft important. Ground units are also often directed in battle from command helicopters.

Hinds were extensively used in the Soviet interdiction efforts in 1984-86, supporting combined-arms and special forces operations and attacking Afghan supply convoys by day and night, sometimes in co-operation with special operations forces. The day and night interdiction effort often sees Hinds working with troop-carrying Hips. The troops can either be inserted first to set up an ambush and call in the Hinds, or brought in to follow up after a Hind attack. Hip airborne CPs function as master bombers, dropping flares. Other types of flare, in patterns known to the Resistance as "little moons", are dropped by twin-engined Antonov transports acting as target-acquisition platforms. By 1985, however, Hinds were making night attacks without flares, using their on-board optics to locate targets.

In the early years of the war reconnaissance patrols were flown by single Hips or Hinds on a fixed route, often at fixed times and at 100-200m altitude. By 1983-84 helicopter reconnaissance had been made more effective. Working as a pair, one helicopter would overwatch as the other moved across a high-threat area, often at low level. Dawn, dusk and night patrols were increased.

As in many other conflicts, helicopters are widely used for casualty evacuation in Afghanistan. The Hind troop compartment has frequently accommodated downed crews. The first Hero of the Soviet Union medal awarded in the war went to a helicopter pilot who had picked up a crew under fire. DRA helicopter crews are skilled at these missions, but are not night-qualified.

While the Hind has attracted most of the attention in Afghanistan, the full range of Soviet helicopters has been committed to the war. The Hips make much of the war possible, frequently acting as attack helicopters, carrying supplies to outposts, and inserting both patrols and heliborne assaults. Hooks and Halos are used for a variety of missions. Hooks lifted artillery into the Panjshir Valley for both the 1982 and 1984 offensives and have taken part in heliborne assaults. Other Hooks have apparently been used to insert BMDs for mechanised raids on Resistance supply routes.

Helicopters are vulnerable on the ground in Afghanistan. A large number have been lost to rocket and mortar attacks and sabotage, though the Resistance lacked the means and training needed to press such attacks when there were few revetments at Soviet airfields. By 1987 the use of Stinger SAMs had forced the temporary evacuation of helicopters from Jallalabad and Samarkhel airfields and the abandonment of a number of forward strips and the outposts around them.

Helicopter losses in Afghanistan have been heavy. Of 70 Mi-17s delivered to the DRA Air Force in 1984, 26 had been destroyed by 1986 and 14 had been withdrawn to the Soviet Union. Of 16 Mi-25 Hind-Ds in the DRA 377th Air Regiment in 1984, ten had been destroyed by 1986. Of the approximately 1,000 aircraft lost in Afghanistan by 1987, over 80% have been helicopters. About a third of those lost have been Hinds. A further 400 aircraft are estimated to have been destroyed during 1987–8. Half of the helicopter losses have been due to operational accidents, while a number of the others have followed Resistance attacks on the ground.

Unit organisation

Helicopter transport regiment

Regimental HQ
Aviation service unit
- Signals flight
- Ground control flight
- Aviation flight (utility section of two Hips, two Hoplites; spares section of eight Hips, two Hooks)

Two or three transport squadrons (four flights of four Hips each)
One transport squadron (three or four flights of four Hooks each)
One aviation technical battalion

This is a Frontal Aviation formation, usually held at front level but possibly attached down to army level. These regiments can handle an entire motorised rifle battalion, plus trucks and a 122mm howitzer battery, in one lift. Such regiments were reported in Afghanistan in 1983 with about 15-20 Hooks and 40 Hips. Smaller lifts are handled by composite forces of about six Hooks and nine Hips. Halos are replacing Hooks.

Attack helicopter regiment

Regimental HQ
Aviation service unit
- Signals flight
- Ground control flight
- Aviation flight (utility section of four Hinds, two Hind-Cs; spares section of 16 Hinds).

Four assault helicopter squadrons (four flights of four Hinds each)

One aviation technical battalion
As in assault regiment, Hinds may be -D, -E or -F, or a mixture. The utility section may retain -A. This type of regiment is usually subordinate to front-level headquarters, although it may be attached down to army level.

Independent assault helicopter regiment

Regimental HQ
Aviation service unit
 Signals flight
 Ground control flight
 Aviation flight (utility section of two Hips, two Hind-Cs; two Hoplites; spares section of 12 Hinds, four Hips)
Three assault helicopter squadrons (four flights of four Hinds each)
One transport helicopter squadron (four flights of four Hips each)
One aviation technical battalion

Independent composite aviation regiment

As above, except one Hind (12-18 aircraft) and two Hip (12-18) squadrons plus at least one fixed-wing squadron. One such unit in Afghanistan had a squadron of An-26 Curl transport and reconnaissance aircraft and was used to support air assault brigade operations.

Army-level squadron

Equipped with approximately 30 Hoplites, attached to each of the five GSFG armies for reconnaissance, liaison and transport.

Army-level attack regiment

Regimental HQ
Aviation service unit
 Signals flight
 Ground control flight
 Aviation flight (utility section of three to five Hoplites; spares section of Hinds and Hips)
One aviation technical battalion
Two Hind squadrons (20-21 aircraft each)
One Hip squadron (20-30)
Each squadron is organised into three or four-aircraft flights. By 1986 there were about 20 of these formations in the Soviet order of battle, including the five in East Germany. Fixed-wing air units can also be put under army-level command if required.

Independent tactical reconnaissance squadron

12-16 Hips and Hinds, used for armed reconnaissance, possibly ELINT, or as pathfinders and master bombers. At least one such unit was in Afghanistan in 1983.

Independent attack squadron

8-16 Hinds. At least one such unit was in Afghanistan in 1983.

Helicopter ECM squadron

12-30 ECM-equipped Hips or Hounds. There is at least one such squadron per front.

Divisional helicopter squadron

Six Hinds, similar numbers of Hips and Hoplites. Organised in six flights in high-readiness divisions, although in divisions in East Germany and Czechoslovakia the number of Hips is increased to eight. In lower-readiness divisions the squadron consists of six Hoplites and two Hips, or is absent altogether. Those in Afghanistan in 1983 each had two Hoplites, two Hip-Cs, six Hip-E/Hs and six Hind-D/Es. In addition to their organic helicopters, divisions can have additional helicopter or fixed-wing aircraft units attached to their command for specific operations.

Air-ground co-operation

As with all its tactical air assets, the Soviet Army's use of helicopters is characterised by the need to reconcile opposing demands for centralisation and responsiveness. The main points of air-ground integration are the Deputy Commanders for Aviation at TVD and front headquarters, who both have extensive staffs. VPUs (*vspomogatelnye punkty upravelniya*, auxiliary command posts), each including an air operations group of eight to ten officers, will be set up by front-level headquarters in major sectors. These command posts are a key element in the employment of Soviet air power; they will not however control helicopter units, which are frequently subordinated directly to army or division-level headquarters.

Working under the front-level headquarters and its command posts, the Air Force representative (*aviapredstavitel'*) at each Soviet division and army headquarters has a staff (four to six men at division level) that assists in preparing air support for the unit. Requests are then relayed – at division this means going through the army-level Air Force representative – to the supporting air units that are subordinate to front headquarters. Alternatively, the commander of an air unit – a helicopter regiment, for example – that has been put under the operational control of a ground combat formation for an offensive may set up a ground forward command post co-located with that of the formation being supported.

The Air Force representatives nearest the "sharp end" are the Air Force guides (*aviavodchiki*). These are pilots, operating in BTRs or jeeps fitted with aircraft radios; they are assigned to combat regiments or, if required, subunits. Their assignment is not continuous, however, and they lack the broad co-ordinating powers of US-style forward air controllers. The responsibilities of these officers have increased with the growing reliance on helicopters as a source of firepower. They have assumed functions reminiscent of those of ground-controlled interception

operators. While Air Force guides do not have radars, they are said to be receiving what the Soviets describe as "computers and automated command and control systems". It has been reported that forces in Afghanistan make extensive use of Air Force guides for co-ordination with helicopters.

VNOS (*vozdushnoye nablyudeniye, opoveshcheniye i suyaz*, air warning, guidance and communications posts) are set up within a few kilometres of the front lines and about 20-30km apart. Each commanded by a pilot from an air unit operating in the sector, these posts act as navigation beacons and communications relays, and provide target information.

The Soviets have improved their air-ground co-ordination since the mid-1970s, moving away from strict pre-planning and increasing flexibility and responsiveness. This change has been made possible by the closer integration of helicopters with ground forces and the increased Frontal Aviation capacity for accurate, responsive delivery of conventional munitions; without it the advantages of improved hardware would have had minimal impact.

Air Force guides and representatives came whenever possible from the unit providing the air support. The Soviets have also trained at least some Army sub-unit commanders to co-ordinate actions with helicopters and direct their attacks.

Afghanistan has been crucial to the development of Soviet air-ground co-ordination. The number of Air Force guides and representatives there is higher than would be expected in a similarly sized force in a general war. Troop columns and major convoys usually have helicopters overhead and also include an Air Force vehicle. Airstrikes can be called in and directed by long-range reconnaissance patrols, which can include Air Force teams.

But not all of the Soviet air activity in Afghanistan is as effectively applied as the convoy protection effort. Most targeting information has to be filtered through operational-level headquarters at Kabul or Termez, which then order strikes the next day. This explains the frequent reports of air attacks on villages the day *after* an ambush or attack in the vicinity. Tactical commanders can however order helicopter attacks in some circumstances – in response, for instance, to current informer or ELINT information on guerrilla locations – and this reduces response time to a matter of hours.

The use of helicopters as airborne command posts is not limited to the location of targets and direction of fighter-bombers, helicopters and heliborne forces. A ground forces commander or chief of staff will use a helicopter as his forward command post in place of the usual armoured command vehicle if the situation requires. Helicopters allow command reconnaissance of forward ground and permit the personal contact with subordinate commanders that the Soviets value so highly. They can also act as platforms for the computers and data links that have become so important to Soviet tactics, and are considered especially valuable on the march, when a division may be strung out over long distances. Helicopters can also be used to move ground command posts forward during an attack. The Hook-C flying command post can be used as the forward headquarters of large formations, in much the same way as two and four-engined transports have been employed in Afghanistan.

Combat usage

Soviet-built helicopters have seen a great deal of combat. In the 1967 Middle East war the substantial Arab helicopter fleets were practically wiped out. Israeli photographs show the Egyptian Mi-6 squadron burning in its revetments.

In 1973 Mi-8s inserted Egyptian and Syrian commandos in successful attacks on the first day of the war, the Syrian assault on Mount Hermon being especially spectacular. But then, starting on the second day, the Arabs discovered the vulnerability of Soviet helicopters. Formations of Egyptian Mi-8s, flying into Sinai at 1,000m altitude, were intercepted by Israeli fighter-bombers and SAMs and suffered heavy losses. On October 18 five Mi-8s were used as level bombers in an attack on Israeli bridges over the Sweetwater Canal. All were shot down by ground fire.

In 1982 the Syrians committed a number of their attack helicopters to Lebanon, although in the end the Gazelle-equipped units were more heavily engaged than the Hinds.

The North Vietnamese used Soviet helicopters to move high-priority supplies into Laos and artillery and SAMs into otherwise inaccessible locations. Hooks handled much of this latter work.

Both sides used Soviet-built helicopters in the 1971 India-Pakistan war. Casualty evacuation appears to have been a major role, while Indian helicopters were used to ferry troops across the many rivers in Bengal and assisted in the capture of Dacca.

Soviet helicopters, flown by Russian crews, were used heavily in Ethiopia. The Cuban offensive that defeated the Somali Army depended on helicopters for both resupply and for mobility over ground that could not have been traversed otherwise. Since 1978 Ethiopia has made extensive use of attack helicopters against guerrilla forces in Eritrea, Tigre and the Ogaden. It has been reported that in Eritrea effectiveness against dug-in positions is limited and that Hind crews are reluctant to close against heavy machine gun fire.

Vietnam has used many of its 200 Soviet-built helicopters in Kampuchea, where they have taken on more of the burden as the US-built helicopter force has declined from shortage of spares. They have been used in both the transport and the attack roles.

Iraqi Hind-Ds have seen action throughout the Iran-Iraq war. They are reported to have been used in the anti-tank role early in the conflict, helping to defeat Iranian armoured forces near the border. Subsequently they were switched to ground support missions, armed with S-5 rocket pods. A rocket-armed Iraqi Hind-D is said to have become the first attack helicopter to shoot down a jet fighter when it won a head-on duel with an Iranian F-4. Even when, as in 1980, they have held the initiative, the Iraqis have proved incapable of using their Soviet-built transport helicopters for effective heliborne offensive action. They still make wide use of Hips, which are needed to resupply many of the strongpoints in the Shatt-al-Arab sector.

The Libyan Hind-D force has been committed to combat in Chad since 1980. It has suffered heavy losses, including three captured on the ground in 1987, without much success to show for it.

The war in Angola has seen much use of the Hip force, flown by Cuban, Angolan and, possibly, Soviet aircrews. However, difficulties with hot-weather operations and maintenance problems have led Angola to seek Western equipment.

Angolan Hinds suffered substantial attrition in 1985–87. Improved UNITA air defence weapons – SA-7s, ZU-23s and US-made Stinger SAMs – were in large part responsible, although several Hinds were destroyed by South African forces, including, according to unconfirmed reports, Impala light attack aircraft.

The Sandinista regime in Nicaragua has large numbers of Soviet-built helicopters, flown, initially at least, by Cuban aircrews. A Sandinista Hip-C was shot down by an air-to-air missile fired by a Honduras Air Force Super Mystère on September 13, 1985, and a Hind-D was damaged by cannon fire. Apart from such cross-border activities, the Sandinista Hind and Hip force remains

San Andres de Bocay, Nicaragua, May 16, 1987: two Mi-17 Hip-H attack helicopters of the Sandinista Air Force are prepared for operations against anti-communist guerrillas. Within hours, one would be destroyed by a Redeye surface-to-air missile, killing its four-man crew, which included at least one Cuban. Armament comprises one 12.7mm machine gun on a flexible nose mount, two UB-32 57mm rocket pods, and two twin 12.7mm machine gun pods. Two 8mm appliqué armour plates—also used on Soviet Air Force and KGB Border Troops Hips—are mounted outside the cockpit. *(Reuters/Bettmann Newsphotos)*

heavily engaged in the war against anti-communist guerrillas in Nicaragua.

Peruvian Hip-Cs were used in border skirmishes with Ecuador in 1982. Despite its problems with hot-and-high conditions, Hip is apparently exempted from the Peruvians' general dissatisfaction with their Soviet-made hardware.

Weapons

While Hind was the first specialised Soviet attack helicopter, attack missions have also been carried out by Mi-2s, Mi-4s and especially Mi-8s armed with rocket and machine-gun pods and Sagger ATGMs on outrigger mounts. Rocket armament comprises UB-32 or UB-16 pods containing 32 and 16 S-5 57mm rockets respectively. With a range of 1,200m and an armour penetration capability of 220mm (in its S-5K HEAT version, possibly more in the S-5MK version), the S-5 is an excellent suppressive weapon; both Hind and Hip can carry a total of 128 in four pods. One pod of the comparable US 2.75in FFAR can inflict heavy damage over a 10m radius, destroying 30% of the light armoured vehicles, 15% of the medium tanks, 40% of the trucks, 35% of the standing troops and 25% of the semi-protected troops caught in the area. A more modern pod, with 20 80mm rockets, can be carried and probably replaces the 57mm pod one-for-one. The HEAT versions of the 80mm rockets are likely to have an armour penetration capability of 350-400mm. Soviet helicopters can carry S-24 240mm fixed-fin rockets, each weighing 225kg, 40kg of which is explosives. These weapons would be used primarily against hardened targets.

The rocket pods may be replaced by 250kg bombs – HE-Frag, semi-armour piercing, white phosphorus or delayed-action incendiary – or by chemical-weapon canisters or napalm. Two of these weapons can be carried per outrigger on the Hip-E and Hind-D/E. If 500kg bombs are used, only one is carried per outrigger, on the inboard hardpoint. The standard method of delivering fuel-air explosive – used against caves and, presumably, minefields – is the 500kg bomb. Soviet bombs in Afghanistan display a high dud rate, perhaps as much as 33% in some areas.

Soviet helicopters carry standard cluster bomb units, both anti-personnel and anti-tank bomblets being packed into the RBK-250 dispenser. The AP version has 60 AO-2.5-2 HE bomblets (each about as effective as an 81mm mortar round, with an estimated lethal area of 3,000 square feet) and the AT version 30 PTAB-2.5-1.5 HEAT bomblets. The latter were estimated to be 80% reliable pre-Afghanistan, but combat experience suggests that the true figure is much lower. Many cluster-bomb units fail to deploy.

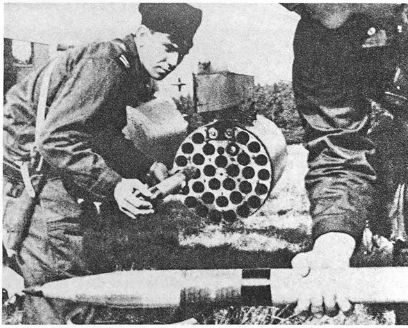
External PFM-1 dispersal units are mounted on the fuselage sides of Hip, each unit containing six 12-mine packets which release the mines in mid-air.

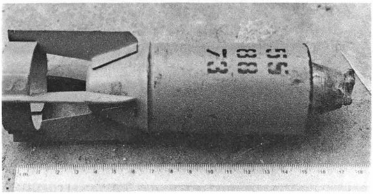
Soviet helicopters may be able to carry PKPE-1 multiple grenade launchers. These twin units would probably be attached to the outriggers. Each contains a broadside of 29 launch tubes for grenades of about 70mm diameter. The grenades are fin-stabilised and can probably be either HE-Frag or HEAT. The PKPE-1 probably fires the grenades in sequence, in the same way as the German MW-1 weapons system.

Helicopter technology

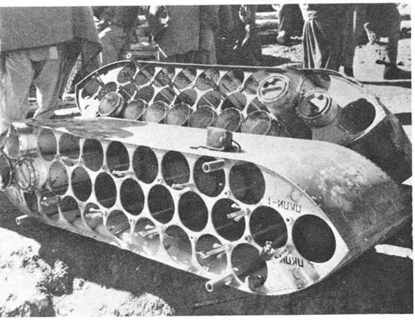
The first Soviet helicopters were crude and unreliable; Khrushchev stated that he was advised not to fly in them. The Secretary himself was able to help to rectify this by personally asking President Eisenhower for two Sikorsky VH-34s, from which the Soviets are reported to have

Loading S-5 57mm HE rockets into a UB-32 rocket pod.





Soviet high-explosive bomblet. Helicopters carry dispensers capable of launching both HE and HEAT bomblets. *(David C. Isby)*



PKPE-1 multiple launcher system removed from a knocked-out BMP in Paktia province, Afghanistan, in 1985. It is believed that the PKPE-1 can also be used on helicopters, one unit attaching to each outrigger. *(John Crawford)*

copied the extruded aluminium spar rotor-blade construction still used today.

All Soviet helicopters are structurally strong and stressed to at least 3g. Hind, Hook and Hip all have strong multiple-plate structures around the engine transmission area, as indicated by the flat inner surface to the access panels on which ground crew stand during engine maintenance.

Rotor-head components (much of the head is steel) and shafting are of cast (not forged) titanium. Turboshaft engines also make extensive use of titanium to withstand the increased turbine inlet temperatures (rather than an increased compression ratio) that, Western engineers believe, account for the increased power of the more recent Soviet turboshafts. Nonetheless, Soviet helicopter engines are still based on 1950s technology, and their power-to-weight ratio is over 40% less than that of comparable Western engines. Despite the increased inlet temperatures, it is estimated that inefficiencies mean that they run approximately 150°C cooler than Western designs, while fuel consumption is about 25% higher. On the positive side, Soviet engines are rugged and simple, requiring minimum maintenance between overhauls. Time between overhauls is 500hr for the turboshaft and gears, and operating life 1,500hr, the same as for the rotor blades. The US Army foresees a maximum 12hr-per-day usage for each helicopter, so the Soviets should be able to sustain a short war with their present equipment. But the inability of the holding unit to perform overhauls on many items of equipment (in line with Soviet policies of centralisation) could reduce operating capabilities in the long term. Hip-Cs have an estimated 750hrs TBO (time between overhaul) for engine, transmission and gearbox. Main-rotor blade life is about 1,500hrs, tail-rotor life a third of that, making the Soviet type more maintenance-intensive than either the UH-1 or, especially, the UH-60.

The Hot Brick jamming system seen on Hips and Hinds since 1982-83 radiates infra-red emissions at a pulsed frequency intended to noise-jam the seeker of an infra-red missile. Typically simple, the system is thought to consist of a block of ceramic material heated by a propane burner.

The mid-1980s saw improved suppressor systems being fitted to Mi-24s and Mi-8s. A streamlined box with an internal shutter behind the intake shields the exhaust, complementing the 120-flare-capacity dispensers and Hot Brick system. It is ineffective against Stinger. A flare dispenser is fitted under the tailboom of most helicopters.

Ka-36/136 Hokum

Main-rotor diameter 14.0m **Fuselage length** 13.5m **Height** 5.4m **Weight, operating** 5,450kg **Powerplant** Two Isotov TV3-117 2,200shp turboshafts **Max speed** 350km/h **Combat radius** 250km

Hokum, flying since 1984, remains little known in the West. It is believed to have tandem crew seating and three-bladed co-axial contra-rotating rotors with wide vertical separation. It has a triple tail, stub wings capable of carrying large ordnance loads, and a retractable landing gear. Large ailerons on the stub wings confer high manoeuvrability. Hokum is believed to have armour protection, infra-red suppressors, an infra-red jammer and flare dispensers. Armament is thought to comprise a side-mounted cannon, unguided rockets, and air-to-air missiles.

Believed to be intended primarily for air-to-air combat against other helicopters, Hokum may also act as a reconnaissance/scout helicopter, a type found in many Western armies but hitherto absent from the Soviet force structure. It could also perform the light anti-tank role,

Artist's impression of Hokum.

armed with ATGMs. The provision of a second crewman in a raised rear cockpit to give clear forward vision, not required in the pure fighter role, supports the contention that Hokum has multiple missions.

A Kamov helicopter with contra-rotating rotors reported in Afghanistan in 1985 may have been a prototype Hokum.

By autumn 1987 the future of Hokum was looking uncertain, no production order having been placed. At least one of the three prototypes was reported to have crashed following a clash of rotors during a high-*g* turn. It is possible that Hokum was intended to compete with Havoc rather than to complement it, and that there was never any intention to produce both.

Mi-1 Hare

Weights 1,863kg empty, 2,358kg normal, 2,550kg maximum **Maximum speed** 170km/h **Cruising speed** 135km/h **Ferry range** 580km **Initial rate of climb** 6.5m/sec **Service ceiling** 4,500m **Hover ceiling in ground effect** 3,300m **Main-rotor diameter** 14.34m (four blades) **Fuselage length** 12.11m **Powerplant** one Ivchenko AI-26V 575hp piston **Accommodation** one or two-man crew plus three troops or two stretchers or 180kg payload **Number built** about 800

The Mi-1 Hare first flew in 1948 and was produced for many years, the Poles taking it over as the SM-1 in 1956. Used for training (the primary role), liaison, casualty evacuation and other light helicopter duties, the Mi-1 in Mi-1T utility and Mi-1U trainer versions is still in Soviet service. About 800 Mi-1s were built.

Mi-2/WSK SM-2 Hoplite

The Mi-2 Hoplite, developed at the same time as the Mi-8, was designed as a turbine-powered replacement for the Mi-1. It is also used for reconnaissance, infiltration, training and, most often, as a transport helicopter comparable with the US UH-1 series. Hoplites are used in

Hovering Mi-1s demonstrate the use of flexible ladders to deliver messengers to ground units. *(US Air Force)*

Mi-2 Hoplite. *(US Army)*

heliborne assaults (especially by Polish units) and can also be armed. Those in divisional helicopter squadrons seem to be used mainly for reconnaissance, possibly acting in conjunction with Hind attack helicopters. An enlarged and more powerful version, the Mi-2M, entered production in 1975. Built solely in Poland, except for prototypes, over 12 versions have been produced, with the USSR receiving two-thirds of the 4,000 output. Armament can include two rocket pods, four Saggers, door-mounted PKM 7.62mm machine guns, or 12.7mm gun pods. Polish (and some East German) Hoplites have carried the full range of helicopter armament, possibly acting as interim attack helicopters pending the arrival of Hinds.

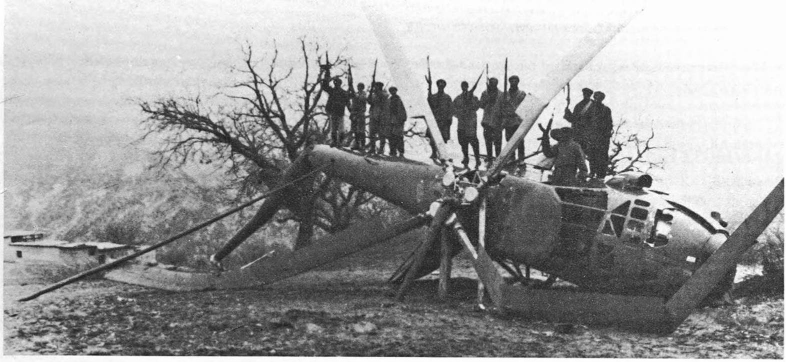
Mi-4 Hound

The first Soviet medium transport helicopter was the piston-engined Mi-4 Hound, designed in 1951-2. It could be armed with a 12.7mm gun and was the first Soviet helicopter to use ATGMs, flying with Saggers in 1967. The standard transport Hound-A has been largely replaced by the Mi-8 Hip. It featured a gondola for the navigator which could also accommodate a machine gun, and bulged circular windows with gunports. Hound-C, a communications jamming version with a large serrated aerial on each side of the fuselage, was first identified in 1977 and probably remains in service. Hound-B is an anti-submarine version.

Hounds are still used for border patrol by the KGB Border Troops, although at least partially replaced in this role by Hind and Hip, and for aerial minelaying, a task now being taken over by Hip.

Hound had a rotor-blade alcohol de-icing system which – partially because it was frequently drained for

Mi-4 Hound-A. *(US Air Force)*



The DRA Hound force has suffered heavy losses throughout the Afghanistan war. This was one of the first to be shot down, falling to Nuristani Resistance fighters (seen standing on their kill) in March 1979. *(US Information Agency)*

moonshining – was supplanted by an electrical system on later designs.

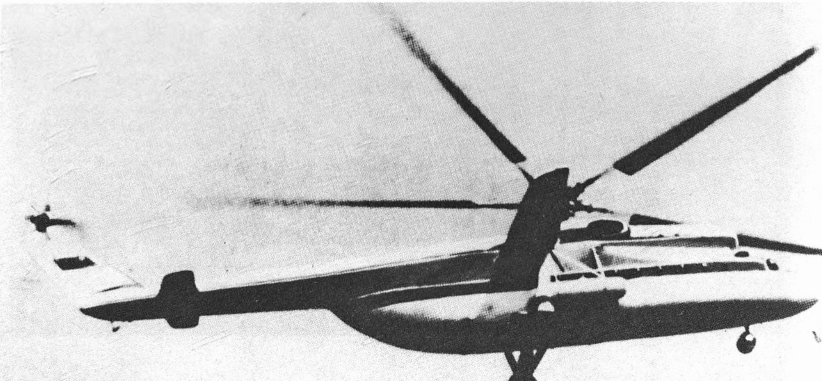
DRA Hounds have seen extensive combat in Afghanistan, taking heavy losses. A total of 3,400 Mi-4s had been delivered by the time production ceased.

Mi-6/Mi-22 Hook

The 1950s-vintage Hook, now being replaced by Halo, represented a great advance in Soviet helicopter technology. It is chiefly recognisable by its stub wings, which provide 20% of its lift at the expense of rotor ground effect and which are removable when the aircraft is used as a flying crane or for spraying decontaminants. Rear clamshell doors allow vehicles and artillery pieces to be carried internally. Externally slung loads are reported to include BMD airborne combat vehicles.

Hooks provide much of the Soviet helicopter resupply capability, with about 400 remaining in service alongside the Halo. Total production, including export examples, is estimated at 860. Following 30 Mi-6 pre-production aircraft, production concentrated mainly on Hook-A, designated Mi-6A by the Soviets, the Mi-6P Hook-B "airline" version being produced only in prototype form. The hold is sized to permit cargo configured for Cub transports to be easily transloaded; cross-section is smaller, however, two Hooks being needed to handle the load of one Cub.

Aeroflot Mi-6 Hook. Many Aeroflot helicopters are camouflaged. *(US Army)*



The Mi-22 designation probably applies to an airborne command post version of Hook-C used in combat in Afghanistan.

Mi-8/Mi-17 Hip

The Mi-8/17 Hip is the standard Soviet transport helicopter. A large, unarmoured, turbine-powered aircraft, the Mi-8 is designed for all-weather, short-range lift operations. It has seen much combat worldwide. Though less manoeuvrable and less capable of nap-of-the-earth flying than the UH-1 or UH-60 of the US Army, Hip will be used for most heliborne assaults. Its substantial lifting ability also allows heavy armament to be carried on outrigger mounts.

Hip has a conventional all-metal, semi-monocoque fuselage with tricycle landing gear. Some examples are fitted with a Doppler radar for low-altitude navigation, with an antenna under the tail boom. To minimise the need for ground equipment, the engines, main gearbox and main rotor hub can be serviced without specialised platforms, the engine panels serving this function in typical Mil fashion. In addition to one large passenger door, there are rear clamshell doors and a hook and winch. It was estimated in 1983 that over 7,500 Hips were in civilian and military service.

Variants include:

Hip-A Single-engined prototype with four-bladed rotor. No longer in service.

Hip-B Prototype, twin-engined with five-bladed rotor. No longer in service.

Hip-C Standard model, entered production in 1962. Three "civilian" versions designated Mi-8 (32/28-seat passenger, 24-seat passenger/cargo, 8/11-seat VIP transport) have a military mission, operated by either Aeroflot or VTA. The standard military version, designated Mi-8T and used primarily by Frontal Aviation and Aeroflot, has smaller, circular windows with gunports; this can also carry 12 stretchers in the medevac role. The outriggers have a total of four hardpoints. A box for Doppler radar is now fitted beneath the tail boom. A BRDM can be carried internally.

Hip-D Airborne communications version of Hip-C, recognisable by rectangular canisters on outriggers and added antennae.

Hip-E The standard Frontal Aviation version is the world's most heavily armed helicopter when used in the attack role, with six hardpoints on outriggers and four launch rails for Swatter ATGMs. Fixed chin armament

Mi-8 Hip-E armed with six 57mm rocket pods and launch rails for four Swatter ATGMs. It also carries a 12.7mm machine gun or 30mm grenade launcher in the nose. This example lacks the exhaust shields, intake shields and infra-red jammer seen on more recent examples. *(US Department of Defence)*

can be either 7.62mm or 12.7mm machine gun or long-barrelled 30mm grenade launcher. Hip-E is also used for troop-carrying; even when fully fuelled and armed, it is reported to be still capable of carrying 12-14 troops, although its speed and hover performance would be rather limited.

Hip-F Export version of Hip-E, used by non-Soviet Warsaw Pact and other nations. Sagger ATGMs replace Swatters. Used as attack helicopter by Angola and Nicaragua.

Hip-G Airborne communications version with antenna under tail boom.

Hip-H The Mi-17 Hip-H is replacing Hip-C as the standard assault and transport helicopter. Up-engined, it incorporates components and systems developed for the Mi-14 Haze ASW helicopter. The outriggers have triple hardpoints, as on the Hip-E, the tail rotor is shifted to the port side, and the cargo hold is slightly enlarged. Dust deflectors and improved single-engine performance (2,200shp possible) make it more efficient in combat.

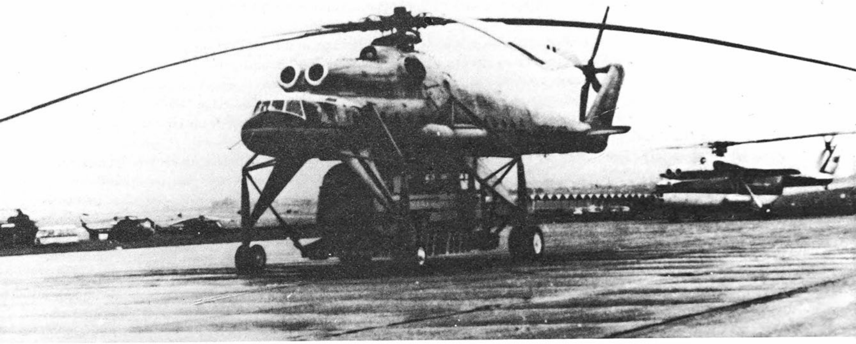
Hip-J and K ECM versions of Hip-C, distinguished by jammer boxes on fuselage side in Hip-J, large communications jammer array on Hip-K. Hip-K has no Doppler radar.

In the attack and transport roles Hips will often carry armament internally and on the hardpoints of the outriggers. In addition, Hips with circular portholes usually have gunports to allow passengers to use their weapons as well. Internal armament can consist of a 12.7mm or 7.62mm machine gun mounted under the cockpit or, as observed on Hip-Es in Afghanistan, a similarly located long-barrelled 30mm grenade launcher resembling the AGS-17. Many Hips in Afghanistan also have one or two rearward-firing PKMS 7.62mm machine guns on flexible mounts in the rear doors to defend against Afghans firing as the helicopter passes by. Flare dispensers are mounted.

Each hardpoint can carry a 250kg bomb, chemical weapons canister, 57mm rocket pod or TKAB-481 12.7mm machine-gun pod. Unlike those of Swatter, Sagger launch rails may be attached to standard hardpoints. Minelaying Hips can carry up to 400 TM-60 anti-tank mines; when dispersing they normally fly in pairs at 4-6kt and 6m above ground level. More frequently, PFM-1 "butterfly" anti-personnel mines are dropped from two fuselage-side external containers, each with a 144-mine capacity. These have been widely used in Afghanistan, inflicting casualties on Resistance, civilians and animals alike. Aeroflot Mi-8s have also been seen with

Hip-F configured as an attack helicopter. Note the characteristic Mil design feature of access panels serving as walkways, as on Hind.

Hip-J is an ECM version of Hip-C, with boxes on the fuselage sides for electronics. A Doppler radar is located on the underside of the tailboom. *(US Army)*



Mi-10 Harke of Aeroflot, with bus on the cargo platform. *(US Army)*

minelaying equipment in Afghanistan. Hips can be used to create smokescreens, laying 24 BDSL-15 smoke pots in two minutes to produce a 5km screen for 15 min.

Hip's manoeuvrability is limited compared to the most recent Western helicopters. Hip-Cs are prohibited from negative-g manoeuvres. In the early stages of the war at least, DRA Hip-Cs had to shut down their engines to refuel, the "hot" refuelling familiar in NATO operations being prohibited. Soviet helicopters do however carry out hot refuellings. The Hip's non-crashworthy fuel system and lack of armour was also unpopular with DRA aircrews. Hip-C performance proved marginal for loaded operations in hot weather at high-altitude landing zones. Trim control was considered inadequate, and the 1,500hr rotor life and time-consuming engine changes were a problem. The electrical de-icer system was considered effective. Availability remained high, however, except when the Soviets failed to give their allies spare parts, which often happened.

Mi-10 Harke

It appears likely that the Mi-10, which entered service in 1961, was originally intended for the ICBM support role, flying equipment and missiles to distant launch sites. It is a derivative of the Mi-6 designed to lift large items of equipment, either slung or on an external platform between its long undercarriage legs.

The Mi-10 gives the Soviets the ability to fly large weapons into otherwise inaccessible areas. It can also be used to recover downed helicopters and aircraft, as US CH-54s did in Vietnam. The Mi-10K Harke-B is a crane version with short landing-gear legs, a small cabin and no platform. The number of Mi-10Ks produced is small compared to the 55-60 Mi-10s, and may in fact have been limited to prototypes.

Mi-24/Mi-25 Hind-A-G

Main rotor diameter 17.0m **Fuselage length** 17.5m **Height** 6.5m **Weight, empty** 8,400kg **Weight, operating** 11,000kg **Max speed** 320km/h **Max cruise** 295km/h **Initial climb** 15m/sec **Service ceiling** 4,500m **Hover ceiling** 2,200m **Combat radius** 160–250km **Powerplant** 2 × Isotov TV3–117 2,200shp turboshafts **Max range** 825km (STOL), 450km (VTOL) **Fuel** 1,500kg

Hind-D, E and F appear to differ primarily in armament rather than performance. The Mi-25 is the export Hind. Radius of action with maximum payload could be a third of that shown.

The original Hind design was not for an attack helicopter but for a fast, manoeuvrable battlefield transport capable of mounting armament and comparable with the US UH-60. According to unconfirmed reports, it was the KGB Border Troops that insisted the Air Force include the squad-sized passenger compartment in its new helicopter; others suggest that high-level Army or Ministry of Defence decision makers regarded a single-purpose attack helicopter as a poor return on investment.

Hind-A was designed in the late 1960s and probably first flew in 1969. Trials were completed and production began in 1972, the first Hinds reaching Soviet units in East Germany in 1973. It soon received the nickname *Gorbach* ("Hunchback"). By 1974 there were two squadrons of Hinds in East Germany; total Hind strength was 150-360 in 1977 and over 650 in 1979, the majority being Hind-Ds. By 1984 over 1,200 Hinds were believed to be in service.

Hind-A is recognisable by its large flat-plate, anti-glint

canopy, tail rotor on the right-hand side, and two-by-two seating for the crew of pilot, co-pilot, gunner/navigator and forward observer or crew chief. Basically an armed transport helicopter, it lacks many of the survivability features of later models. Nose armament is one single 12.7mm machine gun on a swivel mount. As on its successors, the twin TV2-117 turboshaft engines are mounted side-by-side above the cargo compartment. Fuel is carried in underfloor tanks and a main feeder tank behind the cargo compartment, which can accommodate a ferry tank. Drop tanks can be fitted to the wing pylons. (It is likely that all Hind D/E tanks are self-sealing and have armour protection.) The transparencies are not bulletproof in export versions and possibly some Soviet aircraft, which instead have steel armour plates on rollers to give the pilot some protection, while greatly reducing his side vision.

Avionics include a reflector gunsight, VHF and UHF radios, radar altimeter, and a short-range navigation system. A large passenger cabin and access door are fitted. Depending on equipment carried, Hind can lift 8-12 troops or a full load of weapons for re-arming in the combat zone. This feature has been retained throughout the Hind series.

Weapons are carried on the stub wings, which display a large degree of anhedral and have three large weapon pylons and twin wingtip launch rails for ATGMs. Again, this feature is common to the whole series.

Hind features main and tail-rotor blade electrical de-icing. The main rotor has five blades with flapping hinges, drag hinges, swivel dampers and an automatically adjustable flapping-angle regulator which is believed to increase stability and reduce sensitivity to turbulence.

Soviet Hind-As carried the brunt of much of the early fighting in Afghanistan but had been replaced by 1982-83, although DRA Hind-As continued in action for much longer. In 1987 Hind-As were still in use as attack helicopters in the Soviet Union (but not Afghanistan or Eastern Europe).

Hind-B, apparently built only as a prototype or pre-production model, had no anhedral or ATGM rails and only two pylons on its stub wings. It is likely to have been built before Hind-A.

Hind-C did not appear in large numbers. Some have been reported with ATGM launch rails and the machine gun removed, apparently being used for crew training. On Hind-C the tail rotor is switched from starboard to port, a change also seen on some late-production or up-engined Hind-As (with TV3-117s) and on standard production Hind-Ds.

Hind-D is a major improvement on Hind-A. Introduced in 1976-77, it surprised US intelligence agencies both by its sophistication and by the speed with which it appeared. A

An Mi-24 Hind-D of the Soviet Air Force carrying four 57mm rocket pods and four Swatter launch rails in addition to its on-board armament. The flare dispenser is forward of the tail skid. *(US Department of Defence)*

new front fuselage has tandem seating, with individual canopies for the gunner in the forward position and the pilot, whose seat is raised for forward visibility, in the rear. While the wing armament stations remain the same, the undernose 12.7mm machine gun has been upgraded to a four-barrel Gatling-type weapon in a turret mount. Hind-D represents a thorough rework of the basic design to meet the attack helicopter requirement.

Hind-D, as the first true attack version, is more battleworthy than its predecessors. In addition to 7mm of titanium belly armour, Hind-D/E have automatic fire extinguishers, self-sealing tanks and redundant hydraulics. Steel and titanium have replaced aluminium in critical components, and fibreglass-skinned rotor blades have replaced the original metal type. Hind-E is similar to Hind-D, and it is likely that most Soviet (and at least some DRA) Ds had been upgraded to E standard by the mid-1980s. The key difference is that Hind-E can use Spiral ATGMs in addition to the Swatters and Saggers carried by earlier Hinds.

All Hinds have some armour protection, though there are no armoured bulkheads in the cockpit. While there are reports of spaced armour in all Hinds and titanium belly armour on Hind-D/E, Hind-A is protected only against fire striking the cockpit from the front and around the fuel tank in the aft cabin. On Soviet Hind-As only the forward glass surfaces, at most, appear to be bulletproof; Hind-D's glass is reported to be all bulletproof. The glass is also arranged to minimise sun glint, which would give away the helicopter's location or provide a possible target for infra-red SAMs.

Hind may have high-quality steel behind the aluminium skin, forming spaced armour around vulnerable points. Armour is known to be fitted in the cockpit front and around the cabin fuel tank (but not the belly tank) and engine on Hind-A. There are reports that the Hind-D/E armour weighs almost 1,000kg. Hind-D/E have self-sealing fuel tanks. Hind-D's titanium belly armour is said to be proof against most machine-gun fire, and certainly 12.7mm ball. (Afghans have apparently downed Hinds with small arms by firing down on them from high ground.)

Intake plugs on operational Hind-Es help protect against projectiles and debris and limit frontal infra-red signature. They may cause a power loss of up to 10%, and so they are not fitted to Hinds in non-operational roles. The plugs have been retrofitted to Hind-Ds. Hind-D/E, including export versions, have been retrofitted with an infra-red jammer on the fuselage spine, shrouding around the exhausts, and a chaff and flare dispenser forward of the tailskid. All Hinds have a retractable landing gear. Hinds seen in Afghanistan almost always make rolling take-offs.

It is the improvements in avionics and fire-control equipment that make Hind-D so effective. These include a long pitot tube, thought to be a precision low-speed

Head-on Hind-E. This version differs from Hind-D in having attachment points for Spiral tubes rather than Swatter launch rails on its twin ATGM launchers at each wingtip. The spherical protrusion under the chin is the radar sight for the 12.7mm Gatling gun; the box to the left houses the night vision optics. This Hind-E has intake protectors but lacks the exhaust shielding of more recent examples. *(US Department of Defence)*

airspeed sensor for use with the 57mm rockets. What appears to be a laser rangefinder is mounted either on the inboard pylons or, in most cases, on the tip of the port wing. Low-light television is mounted in the chin (although not in Mi-25 export versions), slaved to the 12.7mm machine gun. Apart from its Spiral-launching capability, which led to the Swatter launch rails being replaced by Spiral tube mounts, Hind-E differs from Hind-D in having a repositioned air-data sensor for the fire-control computer; low-light television with a wide field of view; different infra-red equipment, indicated by a spherical rather than an oval shape; and sliding covers rather than hinged doors covering the sensor pods, which are larger than those of Hind-D. Hind-D/E have *Sirena* omnidirectional radar warning equipment, some (not DRA) export versions having older versions or none at all. Mi-24/25s have the LIB missile warning system, intended to detect both infra-red and radar-guided SAMs.

Some of these devices have been retrofitted to Hind-As, which have been seen with a pylon-mounted television pod and an undernose ball mount which is probably connected with Swatter guidance. All Hind versions can carry Saggers on the four ATGM rails. The air-to-air version of the SA-7, currently fitted to Yugoslavian helicopters, probably also arms Hinds and other Soviet helicopters, giving a widespread "strap-on" air-to-air capability.

Hind-D/E have infra-red imaging equipment with a 2-4km range. Although Hind-A crews lacked night sights for their Swatter-B ATGMs, they trained for night action

with rockets and machine guns. The Spiral ATGM fitted to the Hind-E has night capability. Heavy use is made of simulators, especially for weapons training.

The RSBN-6 ADF navigation system and, according to some reports, a Doppler radar (although this is apparently not fitted in many Soviet Hinds and does not appear in export versions) give continuous co-ordinate readout and a map display. The antenna of the standard RV-5 radar altimeter, fitted to most recent Soviet helicopters, is located under the tail boom. In Soviet Hind-D/Es the pilot is reported to have a head-up display. The control system includes stability augmentation and, as in most Soviet helicopters, there are three generators and two electrical systems.

The four-barrel 12.7mm Gatling gun is reported to have a maximum rate of fire of 3,000-4,000rpm, an effective range of 1,500m, and 2,000 rounds of ammunition, one in five of which is tracer. It can traverse 60° left or right, elevate 15° and depress 70°.

According to unconfirmed reports, Hind can carry the AS-8 air-to-surface missile, produced in both anti-radiation and semi-active radar versions. This system has maximum and minimum ranges of 8,000m and 500m respectively, and a maximum flight time of 36sec. Late-model Hinds and Hips may also carry the longer-ranged AS-7.

The export version of Hind-D, designated Mi-25, is used widely, especially by Angola and the DRA. It has reduced avionics and is not capable of using Swatter.

Hind-F, which first appeared in 1979-80, is a Hind-E armed with twin 23mm or 30mm cannon on the starboard side of the fuselage in place of the chin-mounted machine gun, the turret for which has been replaced by a fairing. Hind-F could be an air-to-air version and may be able to fire AA-8 Aphid heat-seeking missiles in addition to SA-7s. The Spiral ATGM and rocket pod armament retained by this aircraft suggests however that it is still intended primarily for use against ground targets, including armoured vehicles. The twin 23mm cannons have an estimated rate of fire of 3,000-3,500rpm, 200-250 rounds per gun and an effective range of 1,500m. There have been unconfirmed reports of further upgunned Hinds under development, including versions with four 23mm or 30mm cannon.

Apparently a specialised NBC reconnaissance version, Hind-G is similar to Hind-E but has "clutching hand" pylons (probably sensor-related) in place of the Spiral launch points. Other additions include a lozenge-shaped housing with a cylindrical insert on the exterior of the port side of the cabin, a starboard bubble window, and a modified tailskid. The gun armament is retained.

It has been suggested that the Hind's wings are capable of reducing the rotor loading by as much as 25%, giving it the ability to carry out 3g turns. They do however reduce hover performance by interfering with the downwash. A 2g turn by a Hind-D at 1,275kg combat load on a standard day requires 90km/h and a 40m radius at 1,000m altitude, increasing to 190km/h and 160m at 2,000m, 220km/h and 225m at 2,500m and 240km/h and 270m at 3,000m.

Although even the latest models of Hind are not as manoeuvrable as the US AH-1 and cannot use the extreme

Mi-24 Hind-F, possibly the world's first air-to-air helicopter. Apart from having twin 23mm (possibly 30mm) cannon in place of the 12.7mm machine gun, it is basically a Hind-E. It retains this variant's sensors and Spiral carrying points; TV3-series engine, apparent in the particle separators protecting the intakes; auxiliary power unit; and rotor cap. This example lacks IR countermeasure, suggesting that it is an operational test machine. Hind-Fs, some DRA-marked, were seen in Afghanistan in 1987. *(US Department of Defence)*

forms of nap-of-the-earth flying upon which American helicopters rely, there is little doubt that the Soviet type is capable of effective operations at low altitude. Among the systems possibly intended to make this possible is a pair of lights set so that their beams intersect when the helicopter is 1m above the ground.

Mi-26 Halo

The Mi-26 Halo was developed as a replacement for Hook. Capable of lifting two BMDs or 90 troops in a cargo hold as big as that of the An-12, Halo has an empty weight only 50% of its maximum permissible take-off weight. Two large clamshell doors are at the rear of the hold.

Designed for operations in limited visibility, Halo has an advanced eight-blade rotor with a strong but lightweight titanium rotor hub. Its powerful twin turboshafts confer hot-and-high performance better than that of earlier Soviet helicopters, and offer greater reliability. All-weather avionics include weather radar, Doppler radar, radio navigation aids, and a moving-map display.

Halo entered Air Force service no later than 1982, possibly earlier. At least small numbers in Aeroflot markings were in action in Afghanistan in 1983, and the type started equipping units in the Groups of Forces in Eastern Europe in January 1986. It represents a substantial improvement in the Soviet ability to move and, especially, to resupply Army units by helicopter, being able to carry 20 tonnes for 800km. One likely role is the resupply of armoured spearheads. As with all Soviet helicopters, Aeroflot versions may be used interchangeably with those in the Air Force. The total Halo force was over 80 strong by 1987 and is expected to exceed 250 in the 1990s.

A twin-rotor heavy-lift Halo follow-on capable of lifting 50 tonnes was under development in 1987–88.

Soviet Air Force Halo sprays decontaminant in the neighbourhood of the Chernobyl reactor in 1986. Hinds were also used for NBC reconnaissance and spraying. *(US Department of Defence)*

Mi-28 Havoc

Main-rotor diameter 17.0m **Fuselage length** 17.4m **Operating weight** 10,000kg **Max speed** 300km/h **Combat radius** 240km **Powerplant** 2 × Isotov turboshafts

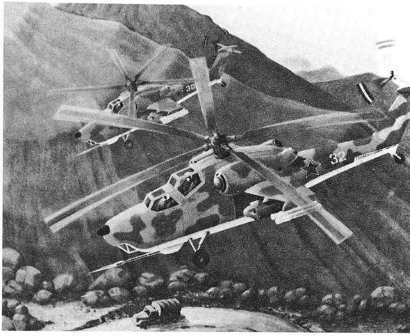
The Mi-28 Havoc, scheduled to become operational in 1987-88, will supplement Hind in the Soviet attack helicopter force. Tandem seating for the two-man crew (pilot to the rear) and the absence of an amidships cabin make it a smaller target than its predecessor. Havoc retains a number of Hind features, however: twin side-by-side engines, stub wings for armament, and a heavy weapons load. Although the main-rotor diameter appears to be much the same as that of the Mi-24, the rotor head is of new design, and the tail rotor is switched to the starboard side of the fin. A slim fuselage dictates side engine pods.

The engines may well be the same Isotov TV3-117 turboshafts that power Hind or an improved version, possibly designated TV4-117; upturned jet nozzle minimise infra-red signature. Infra-red suppressors and flare dispensers similar to those on Hind will probably be fitted.

Havoc will be the first Soviet helicopter with crashworthy landing gear. It is believed to be comparable to that of the UH-60A, which provides 95% survivability at impacts of up to 11m/sec. Hip's landing gear has limited absorption capability, Hind's, being retractable, none.

Havoc and Hokum are both believed to carry a wide variety of sensors, including nose-mounted radar and night optics. The radar (Hind is reported to lack radar) has an air-to-air capability, with a detection range of 30km and a tracking range of 20km. An improved omnidirectional radar homing and warning system is also believed to be fitted. Havoc is probably capable of carrying air-to-air missiles as well as the full range of Soviet ATGMs, bombs, rocket pods and chemical warfare canisters. It has been suggested that Spiral may be mounted in quadruple launchers, allowing a maximum load of no fewer than 16 ATGMs. Havoc is reported to be able to carry a broader range of air-to-surface missiles than Hind, possibly including the AS-14 Kedge.

The DIA believes that Havoc will complement rather than replace Hind. The former seems more suited to Western-style attack helicopter tactics than Hind, using concealment to approach targets acquired by ground forces or scout helicopters. It appears to be optimised for use against armoured forces in Europe, using low-level


Artist's impression of Havoc in action. *(US Department of Defence)*

flight, terrain masking and pop-up attacks, all of which put a premium on a low silhouette and low-altitude manoeuvrability. In these respects Hind – intended to rely on speed and armour rather than concealment and manoeuvrability for protection – falls short of its Western counterparts. Havoc is reported to be capable of pulling −0.5g.

Mi-30/31/32(?) tilt-rotors

	Mi-30	Mi-31	Mi-32(?)
Role	close air support	transport	transport
Crew	2	2–3	3
Weight	unknown	9 tonnes	18 tonnes
Engines	2 turboprops	2 turboprops	2 turboprops
Speed	unknown	550km/h	550–650km/h
Endurance	unknown	3.5hr	3–6hr
Weapons	heavy	capable	limited types
Troop capacity	unknown	15	30

Data estimated. Mi-30/31 may be one and the same aircraft, in which case it would be designated Mi-30.

There have been repeated reports of a Soviet tilt-rotor aircraft. similar perhaps to the US XV-22 and attributed to the Mil design bureau. One version may have attack as its primary mission, suggesting that it is the follow-on to the Hind in the close air support role, and another could be a transport capable of lifting 15 troops. These aircraft may be designated Mi-30 and Mi-31 respectively. Air assault, anti-helicopter, troop transport, forward air control, special operations and electronic warfare have been suggested as possible missions.

A larger version, possibly designated Mi-32, may be intended for transport missions. Capable of lifting 30 troops, this may eventually be the Hip replacement. Missions would include troop transport, air assault, special operations, electronic warfare, and airborne command post. Aeroflot would probably also operate this type.

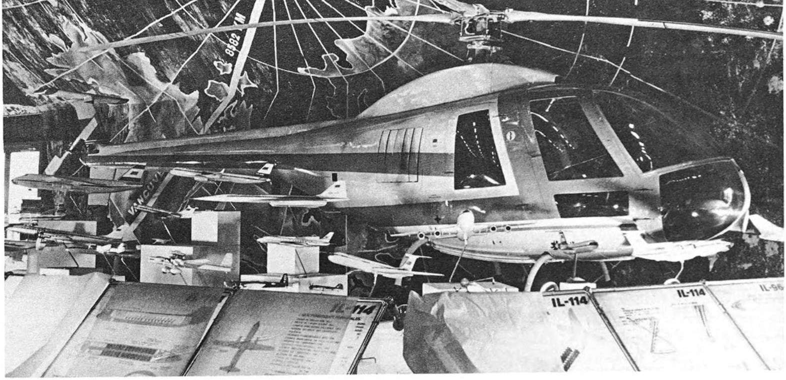
Soviet tilt-rotor design started in the mid-1970s, and a prototype is believed to have flown in 1984-85. Production may have started in 1986-87. The Mi-30/31/32 may also incorporate tilt-wing technology with wingtip strakes.

Mi-34 Hermit

Length 8.57m **Rotor diameter** 10m **Cabin width** 1.2m **Height** 2.8m **Cruising speed** 180km/h **Maximum speed** 210km/h **Normal weight** 1,200kg **Maximum weight** 1,250kg **Range** 450km with 90kg payload **Service ceiling** 4,500m **Hover ceiling** 1,500m **Maximum loading** 2.5g

A replacement for the Hare in the trainer role, the piston-engined Mi-34 first flew in 1986. It is powered by a Vedeneev M-14V 325hp engine. Both single and two-seat versions are to be produced, and a turboshaft-powered version is under development.

The Mi-34 is a competitor to the Polish PZL Swidnik SW-4 project, and will probably be produced in Poland. Its simplicity and piston engine will permit its use for DOSAAF basic helicopter training throughout the Soviet Union. Other roles could include liaison, patrol, and aerobatic and tactical training.



Type	Mi-2 Hoplite	Mi-4 Hound	Mi-8/17 Hip	Mi-26 Halo
First flown	1961	1952	1961/76	1977
Production	1963–	1953–69	1966/80	1980
Empty weight	2,372kg	5,200kg	6,816/7,100kg	28,200kg
Normal take-off weight	3,550kg	7,150kg	11,100kg	49,500kg
Max take-off weight	3,700kg	7,550kg	12,000/13,000kg	56,000kg
Payload (max)	800kg	1,740kg	4,000kg	20,000kg
Payload (slung)	800kg	–	3,000kg	20,000kg
Fuel (max)	500kg	700kg	1,458kg	8,650kg
Fuselage length	11.4m	16.79m	18.31/18.42m	33.72m
Main rotor diameter	14.5m (3 blades)	21.0m (4 blades)	21.29 (5 blades)	32.0m (8 blades)
Height	3.45m	5.18m	5.6/4.75m	8.14m
Engine	2 × Isotov GTD-350 400shp turboshafts	1 × Shvetsov ASh-82V 1,700shp piston	2 × Isotov TB-2-117A/TV3-117MT 1,500/1,900shp turboshafts	2 × Lotarev D-136 11,400shp turboshafts
Max speed	210km/h	210km/h	260km/h	295km/h
Cruising speed	160km/h	180km/h	225/240km/h	255km/h
Range (max load)	170km	200km	460/495km	800km
Ferry range	580km	410km	950km	–
Initial climb rate	4.5m/sec	5.0m/sec	6.5m/sec	–
Service ceiling	4,000m	5,000m	4,500/5,000m	4,600m
Hover ceiling*	2,000m	1,700m	1,800m	–
Cargo hold†	2.27 × 1.2 × 1.4m	4.2 × 1.86 × 1.6m	6.3 × 2.34 × 1.82m	12 × 3.25 × 2.95m
Cargo door‡	1.12 × 1.07m	1.86 × 1.60m (ramp)	2.34 × 1.82m (ramp)	–
Troops	8	14	32/36	85
Stretchers	4	8	12	50+
Crew	1	2–3	2–3	5
Weapons hardpoints	4	4	4/6	nil
MGs (if fitted)	–	1 × 12.7mm	3 × 7.62mm	nil

*In ground effect. † Length × width × height. ‡ Width × height. In Hip column, second figures are for Mi-17 Hip-H where this variant differs. On Hip, one 7.62mm machine gun may be replaced by a 12.7mm weapon.

Left Mi-34 light helicopter. *(Flight International)*

Foreign usage

The Mi-1 was produced in Poland, starting in 1969, and designated the SM-1. Soviet and Polish-built versions were exported to the Warsaw Pact nations, Afghanistan (used for training), Albania, China, Cuba, Egypt, Finland, Guinea, Iraq, South Yemen and Syria.

The Mi-2 was exported from Poland to Bulgaria, East Germany, Hungary and Romania.

The Mi-4 was exported to Afghanistan, Algeria, Austria, China, Cuba, Czechoslovakia, East Germany, Egypt, Finland, Ghana, Hungary, India, Indonesia, Kampuchea, Nepal, North Vietnam, Pakistan, Poland, Romania, Somalia, Syria, Yemen and Yugoslavia.

Mi-6s were exported to Bulgaria, Egypt, Indonesia and North Vietnam.

Mi-8/17s have been exported to Afghanistan, Algeria, Angola, Bangladesh, Bulgaria, Cuba, Czechoslovakia, Egypt, Ethiopia, Finland, Guinea-Bissau, Hungary, India, Iraq, Laos, Libya, Madagascar, Mali, Mongolia, Mozambique, Nicaragua, North Korea, North Yemen, Pakistan, Peru, Poland, Romania, Somalia, South Yemen, Sudan, Syria, Vietnam, Yugoslavia and Zambia.

The Mi-10 has not been exported.

The Mi-26 has been exported to India. Other export sales are likely to follow.

Hind was not exported until the late 1970s. All Warsaw Pact air forces except that of Romania have received at least small numbers of Hind-Ds. Libya has received 26 Hind-Ds. Other Hind operators include Algeria, Angola, Cuba, Ethiopia, Iraq, Nicaragua, North Yemen and Peru.

Type	Mi-6 Hook	Mi-10 Harke (Mi-10K)*
First flown	1957	1960 (1965)
Production	1959–81	1960–81
Empty weight	27,240kg	27,300kg (24,680)
Normal take-off weight	40,500kg	38,000kg (32,000)
Max take-off weight	42,500kg	43,450kg (38,000)
Payload (max)	12,000kg	15,000kg (11,000–14,000)
Payload (slung)	9,000kg	8,000kg (11,000–14,000)
Fuel (max)	9,804kg	6,340kg
Fuselage length	33.16m	32.86m
Main rotor diameter	35m (5 blades)	35m (5 blades)
Height	9.86m	9.9m (7.8)
Engines	2 × Soloviev D-25V 5,500shp turboshafts	2 × Soloviev D-25V 5,500shp turboshafts
Max speed	300km/h	200km/h
Cruising speed	250km/h	200km/h
Range (max load)	620km	220km (240)
Ferry range	1,450km	630km (795)
Service ceiling	4,500m	3,000m
Cargo hold†	12 × 2.65 × 2.01m	20 × 10 × 3.1m
Cargo door ‡	2.65 × 2.5m	nil
Troops	70	28
Stretchers	41	–
Crew	5	2–3
MGs	1 × 12.7mm	nil

*Figures in parentheses are for the Mi-10K flying crane where they differ from the standard Mi-10. Cargo-hold figures indicate external platform with the Mi-10.
†Length × width × height.
‡ Width × height.

Chapter Eighteen

Engineer equipment

The Soviet Army demands a high rate of advance throughout its operations. Soviet engineers help to achieve this goal by clearing mines and obstacles, crossing and bridging water barriers, building and maintaining roads, and keeping the lines of communication open. Engineers aid combat as well as movement, digging field fortifications and creating minefields and obstacles. The Soviets field a wide variety of engineer equipment which is generally simple and rugged but often technically excellent: the PMP pontoon bridge system was acknowledged to be the finest in the world, and the US Army could only slightly improve on it with the Ribbon Bridge. Supplementing the engineer equipment are "strap-on" items such as mine rollers, mine detectors and dozer blades that give combat vehicles the ability to perform some engineer tasks. Engineer equipment is provided in large quantities throughout the Soviet Army and engineer units are provided at all units from regiment up to front, usually being attached downwards to the units that will most need their support. Command of engineers is centralised as much as possible, allowing an efficient allocation of resources and concentration when needed. All units of regiment and larger strength have a Chief of Engineers (who in regiments is also the engineer company commander) to control engineer activities in his unit.

Tactical employment of engineer detachments

Soviet engineer units, unlike most Soviet combat units, are tactically employed in ad hoc mission-tailored detachments attached to manoeuvre units. Only pontoon bridge and assault crossing units are not used in these types of detachment. The major types of Soviet engineer detachments include the movement-support detachment, OOD *(otriad obespecheniia dvizheniia)*; engineer reconnaissance patrol, IRD *(inzhenernoe razvedyvatel'nyi dozor)*; reconnaissance/obstacle-clearing detachment, OR *(otriad razvedki i razgrazhdeniia)*; and the mobile obstacle detachment, POZ *(posvizhnoi otriad razgrazhdenii)*.

The movement-support detachment is highly mobile, normally built around a road engineer sub-unit. In a march formation the movement-support detachment is well to the front, one to two hours ahead of the main body. The composition of a movement-support detachment varies with its mission. It often includes tank and motorised rifle units for security, BRDM-RKhs and RKhMs for NBC monitoring and marking contaminated zones, and sapper engineer units. In some cases a sapper engineer sub-unit rather than a road engineer unit may be used as the basis of a movement-support detachment. A movement-support detachment has many missions, including reconnaissance of the route of march and the removal of any obstacles or mines along it, bridging water obstacles, and marking the route to avoid contaminated areas. Sub-groups may be formed to handle these tasks. It the movement-support detachment encounters the enemy it will retire and let the following tank or motorised rifle unit's advance guard engage, and then proceed behind them. If the enemy is strong the movement-support detachment may have to follow the unit's first echelon. Each separate axis of advance will have its own movement-support detachment.

Engineer reconnaissance patrols advance along each axis of advance. They can form part of the patrols of reconnaissance units, or whole engineer sub-units can perform the reconnaissance mission, using their expertise to report back on conditions – the state of roads and bridges, for example – and assess the engineer tasks that will have to be performed by following units. Helicopters are also used as vehicles for engineer reconnaissance patrols.

Reconnaissance/obstacle-clearing detachments are sometimes part of a movement-support detachment, but they frequently operate independently. Their main function is the clearing of minefields and obstacles, and they will often immediately precede the combined-arms assault. In the outflanking and enveloping attacks that the Soviets emphasise, these detachments are required both to locate and remove anything that would inhibit mobility.

The mobile obstacle detachment is also used to create obstacles and lay minefields whenever they are needed, on the attack or defence, whether it is to protect the flank of an advancing unit from counterattacks, consolidate a captured position or force an enemy armoured breakthrough into the "fire pockets" of the defenders. The Soviets place a great deal of emphasis on these mobile obstacle detachments. They are the catalyst of their

overlapping anti-tank defence system. On the march, mobile obstacle detachments are positioned on the flanks of the column. In both attack and defence they are frequently part of the anti-tank reserve.

Engineer support in the offensive

All Soviet engineer weapons contribute to offensive capability. The field fortification diggers will be employed to create hasty positions for towed artillery and especially SAM and SSM units. If time permits, engineer sub-units will aid in creating camouflaged and secure assembly areas. In any case, movement-support detachments may lead the Soviet units as they leave the assembly areas for the line of departure. When time does not permit this, tanks with dozer blades will be relied upon for cross-country mobility. The Soviets realise the importance of such vehicles for mobility, as demonstrated by the Israelis when they created their own desert tracks with dozer blades in 1967. T-64/72/80s, with their retractable dozer blades, will require less support. These blades are also useful for moving surface mines out of the path of these tanks.

The most important offensive task is the breaching of minefields. The number of lanes to be cleared through enemy minefields depends upon the formation adopted by an attacking unit when crossing it. This in turn depends upon the opposition expected, and can range from one lane per company to one per platoon. The normal method of clearing is by tanks mounting the KMT-4 and KMT-5 mine ploughs and roller-ploughs. Because of the narrowness of paths created by the tanks, explosives, especially rocket-propelled line charges fired from specialised mine-clearing vehicles, modified tanks or UR-66/77s, will project an explosive hose across the minefield, detonating it to clear a lane.

Bangalore torpedoes and explosive charges, emplaced by sappers on foot, can also be used to clear minefields and obstacles. A battalion that has to attack through minefields will normally have at least one or two sapper platoons, up to nine mine rollers and three dozer blades for attachment to tanks, one or more MTU bridges and 300-600kg of explosives. The combination of rollers and ploughs, line charges (both rocket-propelled and winched forward), bangalore and explosive charges, and, if required, manual clearing (only performed when there is no alternative or when silence is required) gives the Soviets the redundant, overlapping mine-clearing capability that they believe will result in battlefield effectiveness.

Artillery barrages are often used to clear minefields. In Afghanistan air-dropped fuel-air explosive (FAE) has served the same purpose. This weapon, introduced by the Americans in South-east Asia, produces very high overpressure, extremely effective against minefields. Field expedients will also be used: in the Second World War the Red Army sometimes drove herds of pigs before them in an attack, and in Afghanistan disabled vehicles have been pushed forward over mined areas.

Mine-clearing is not seen as solely an engineer's task. The Soviets stress that any unit should be able to lift or plant mines if required. Each artillery battery is normally equipped with a number of mines for local defence of its position; these are frequently surface-laid on potential avenues of approach for enemy tanks.

Mobile obstacle detachments are also used in the offensive, as part of the anti-tank reserve. They create obstacles and emplace minefields to protect the flanks of advancing units and consolidate positions, as well as aiding the hasty defence if the attack is halted.

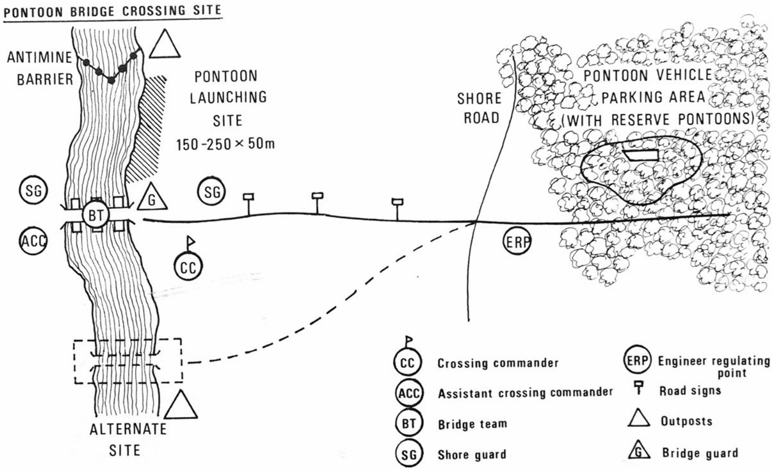
Engineer support in the defence

While the Soviets view the defensive as a temporary measure, extensive field fortifications have long been a Russian strength. Soviet engineers both prepare defensive positions and participate in the action. The preparation for the defence includes constructing and camouflaging field fortifications, preparing demolitions, emplacing minefields and preparing routes for the Soviet counter-attack and resumption of the offensive. Whenever possible, the Soviets will take full advantage of engineer equipment to improve their defensive strongpoints. Prefabricated and field fortifications can be brought forward by truck or helicopter (as in Afghanistan). Engineer observation posts are established throughout the defences to aid in these tasks. Engineer reconnaissance detachments can also be used to help select defensive positions, but it is the mobile obstacle detachments that have the largest defensive role, operating as part of the unit's anti-tank reserve.

Engineer support in river crossings

Facilitating the river crossing is seen as one of the most important missions of Soviet engineers. While every effort has been made to give Soviet tank and motorised rifle units their own river-crossing capability, engineers are still most important in allowing the Soviets to achieve the high rates of advance they demand across Western Europe, where rivers are close and often wide. They have evolved a wide range of amphibious vehicles, ferries and bridging that will help them to maintain their momentum.

Engineer reconnaissance detachments will investigate and report on all water obstacles along the line of march. Using specialised equipment – including IRM reconnaissance vehicles – to determine depth, current and



width and, if necessary, scuba divers to check on bottom conditions for fording or snorkelling, these detachments will mark appropriate crossing sites. They will be supplemented by other reconnaissance means such as troop reconnaissance patrols, aerial photographs and prisoner of war interrogation. The information will be passed to the unit's Chief of Engineers, who, along with the unit commander, will plan the river crossing in such a way that the advancing Soviet units can continue without having to stop and consolidate bridgeheads. Engineer bridging units will either be brought up to the front of the column, if time and road conditions permit, or will be kept back and will "leapfrog" forward when the river is reached. Helicopters will often be used to lift troops or engineers to the far bank. MTU tank-mounted bridges will probably be the first engineering equipment on the scene, either with a forward detachment or *reydy* or attached to the advance-guard battalion of the leading regiment. If the MTU is not adequate to bridge the river, regimental TMMs will be used, but no bridges will be erected until the crossing site is secured from enemy direct-fire weapons. This may require the BMP and APCs to swim across. Tanks will normally not cross in the first echelon because of the extensive preparations required for snorkelling. Tanks will either be ferried across by GSP ferries or PMP bridge sections used as ferries, wait for a bridge to be constructed, or will snorkel or be winched across underwater. PTS amphibians will also set up a crossing site until a bridge can be established. The ferrying and rafting operations will continue until the area is secure, and then the bridge, usually a PMP from the divisional engineer battalion, will be built. The PMP set, like all divisional crossing assets, may be pushed forward with the first-echelon regiments if a crossing is anticipated.

Opposed river crossings are very difficult operations that require large numerical superiority and careful preparation, especially by engineers. The river banks and bottom are likely to be mined, and will have to be dealt with by underwater equipment or line charges. While the first echelon will swim across in APCs or BMPs, ferries will bring across tanks and heavy equipment as soon as possible. The Egyptian crossing of the Suez Canal on October 6, 1973, was an example of such a crossing.

Engineers in Afghanistan

Soviet Army engineers have played a major role in the war in Afghanistan since its start, with mine clearance one of their primary missions. At the start of the war the Afghans had no experience in mine warfare. Most of the Kabul regime's stockpile of TM-46 anti-tank mines was soon in Resistance hands, however, obliging the Soviets to put DIM mine detectors on UAZ-469 jeeps at the head of armoured columns. These proved vulnerable to snipers, and the DIMs were moved to T-62 tanks. The Afghans

countered by burying bomb fragments and sniping anyone who tried to clear the "mines". New mines have allowed more sophisticated tactics, but the Afghans have never been as adept at mine warfare as the Vietnamese.

By 1984 substantial numbers of plastic anti-tank mines – known as "Italian" mines to Russian sappers – were being used by the Resistance, while the Soviets were reported to be relying heavily on mine-sniffing dogs for their detection. This solution would not be satisfactory in mobile warfare. Hand-held detectors and probes are also used. Tank-mounted mine rollers were employed in the 1984 Panjshir VII offensive. (In 1982 the Soviets discovered that the Panjshiri resistance had learned the old Vietcong trick of attaching dud bombs to landmines, and so took additional precautions after a few tanks had met spectacular ends.)

Mine clearance remains a major problem in Afghanistan. Along with the poor state of most roads and tracks, it means that the Soviets must have obstacle-breaching detachments at the head of troop columns.

AVLBs have been used to cross stream beds during offensives. A large line-of-communications pontoon bridge was thrown over the Amu-Darya river but subsequently replaced by a permanent structure.

While numbers of diggers and entrenching vehicles have been used in Afghanistan, the Soviet Army was slow to harden its facilities or to dig in while in the field. This is surprising in the light of the Soviets' hardening programme in Europe. As late as 1987 there were still no revetments on at least some airfields in Afghanistan.

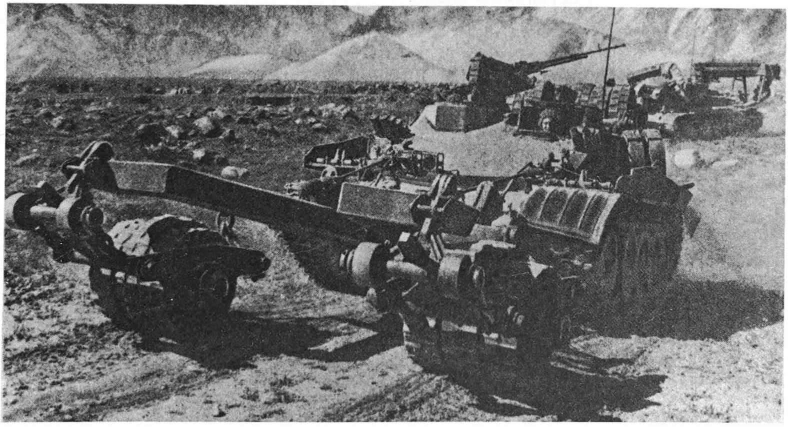
One engineer task that appears not to have had high priority in Afghanistan is road maintenance. The limited surfaced road network has deteriorated under the pressures of Resistance mining and Soviet convoys. The amount of supplies that can be carried on the roads may thus place a limit on any substantial increase in Soviet troop strength in Afghanistan.

Soviet sapper and air assault units have made extensive use of RPO and RPO-A flame weapons in Afghanistan.

Effectiveness and capability

Soviet engineers appear to be a relatively effective force. Their equipment meets the Soviet standards of simplicity and ruggedness, and its effectiveness in the hands of the Egyptians in 1973 suggests that it will be at least as good in the hands of the Soviet Army. While the limited training time available to Soviet enlisted personnel may reduce the multi-purpose capability which the Soviets seek, it would appear that they are at least effective in their primary tasks. Any individual weaknesses can be made up by the relatively lavish scale on which the equipment is provided.

M-1987/1 T-55 or T-62-based mineclearing tank seen in Afghanistan in 1987. Armed with smoke mortars and a 12.7mm machine gun, it may be a converted IT-1 tank destroyer (produced in service test quantities but never deployed) made available for engineer work. Similarly, IT-130 tank destroyers have been converted into T-62-T M-1977 tank recovery vehicles. In the background is an IMR combat engineer vehicle.



This was also seen in the 1973 War. The Egyptians had large enough stockpiles of PMP sections to ensure that any bridge damaged by Israeli bombs could be back in service within minutes. Already the Soviets have stock-piled prefabricated line-of-communication bridges throughout Eastern Europe, and similar measures will doubtless be taken with tactical bridges. While it is uncertain whether Soviet mine-clearing methods and tactics will be adequate to deal with the new generation of artillery-delivered minelets, and with the plastic anti-tank mines that have proved so hard to counter in Afghanistan, it remains true that Soviet mine warfare capability is the equal of any in the world.

Unit organisation

Regimental engineer sapper company (tank and motorised rifle regiments)
Total strength: 60–100 officers and men.
Headquarters and services (16–22 officers and men, three (in MR) or nine (in tank) KMT-5M, nine (MR) or 27 (tank) KMT-4/6, one (MR) or three (tank) MTU/MT-55, eight (MR) or nine (tank) trucks, one jeep, three BTU, four BTR-60, four RPG-16.
One road-bridge platoon (29–33 officers and men)
One road section (one DIM, one BAT/PKT, bridge parts)
One bridge section (four TMM)
One field fortification section (one BTM or MDK-2, three PZM)
One sapper-minelayer platoon (12–15 officers and men)
Three sections
Total equipment: three PMR-3/PMZ-4 or three GMZ (M-1977); plus three pioneer kits, one demolition kit, three KR clearing kits
Two sapper platoons (each of 27 officers and men)
Three sections
Total equipment per platoon: two APC or truck, nine mine detectors, three pioneer kits, three KR clearing kits, three demolition kits, three chain saws, mines, explosives, and bridge elements when required.
Some companies have a construction platoon (two dump trucks, one crane truck, two E-305V, one maintenance van) instead of the two sapper platoons.

Reconnaissance frogmen may be attached to deal with water obstacles. Sapper platoons are probably armed with RPO and RPO-A flame rockets. Five KMM may be used instead of four TMM. Additional trucks are required to lift tank regiment mine-clearing equipment, which is usually distributed to the tank battalions.

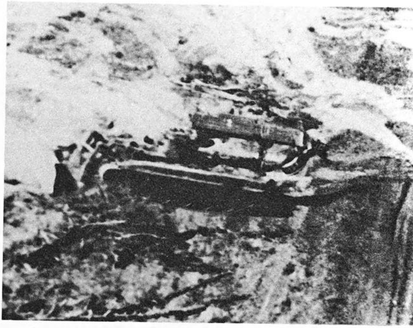
Divisional engineer battalion (tank and motorised rifle divisions)
Total strength: 30 officers, 378 enlisted men in motorised rifle divisions; 31 officers, 401 enlisted men in tank divisions.
Headquarters company
Total strength: nine officers, 59 enlisted men.
One headquarters platoon (two APC, one BRDM, two signals vans, two jeeps, three trucks)
One reconnaissance platoon (three trucks, three BTR APCs carrying six mine detectors, one DIM system, three pioneer kits, three KR clearance kits, mine-sniffer dogs, three scuba kits)
One material support platoon (one APRIM-M, one TRM-A/B, 17 trucks, 4 vans)
Engineer sapper company
Total strength: five officers, 65–89 enlisted men.
One headquarters and service platoon (one to three trucks with KMT-5, one truck with KMT-4 or -9, one to three trucks with BTU, three cargo trucks)
One minelaying platoon (600 anti-tank mines, three PMR-3/PMZ-4, three APC or trucks *or* three GMZ; three pioneer kits, three KR clearance kits, one demolition kit)
One or two sapper platoons (with a total of three–six APCs/ trucks, six mine detectors, six pioneer kits, six KR clearance kits, two demolition kits, UZ charges, bridge elements when required, two DIM, two IMR, two to six UR-67/77 mine-clearers)
Engineer road company
Total strength: nine officers, 60-117 enlisted men.
One headquarters platoon (one K-61 or PTS, one MAV or BRDM)
Two engineer road platoons (with a total of two BAT, eight TMM, one E-305V, two dump trucks, two graders)
One engineer bridge construction platoon (one KMS set, one LRV with ESB-4-ID, one K-61 with crane, one ESD-20, three-plus trucks with bridge elements)
One field fortification platoon (two or three BTM or PZM, one or two MDK-2, one truck with ESB-4-IG, three-plus trucks with prefabricated shelters, UZ charges, shaped charges) (platoon not included in some units)
Pontoon bridge company
Total strength: four officers, 82 enlisted men
One headquarters platoon (one-plus trucks, roadway matting)
Two pontoon bridge platoons (with a total of two PMP shore link "square" sections and 16 PMP river link "boat" sections carried on 18 KrAZ-214/255B)
One boat platoon (six BMK-150 or BMK-T motorboats on KrAZ or ZIL trucks)
Assault crossing company
Total strength: five or six officers, 39-54 enlisted men (tank division battalions use greater strength).
One headquarters platoon (one crane truck)
Two transport platoons (with a total of 12 K-61/PTS

or 12 PKP with PTS)
One (two in tank division battalions) ferry platoon (with three GSP ferries)
One assault boat platoon (with ten NDL-10 boats)
One reconnaissance diving and demolition platoon (one BRDM)

Assault crossing battalion (one or two per army, up to three per front)
One headquarters company (including a reconnaissance platoon, three IMR, three BREM, three BTM/MDK-2, three BAT-M/PKT)
Two transporter companies (each with 18 K-61 with PKP, or PTS with PKP)
One or two ferry companies (24 GSP ferries per company in units with two companies, 18 GSP ferries in units with one company)

Pontoon bridge regiment (one per army, two per front)
One headquarters company (eight K-61/PTS, ? GSP ferries)
Two pontoon bridge battalions (each of three pontoon bridge companies identical to those in the divisional battalions)

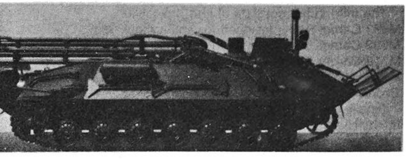
Engineer regiment/brigade (army or front level)
One headquarters and services element
One construction battalion
Three engineer battalions



An IMR-2 combat engineer vehicle with its dozer blade extended and lifting arm in travelling position. This vehicle, based on the T-72 tank, was used in the Chernobyl clean-up operation in 1986. *(US Army)*

Combat engineer vehicles, ditchers, diggers and dozers

IMR combat engineer vehicle Weight 34,000kg; length 10.6m; height 2.48m to crane operator's cupola, 3.37m to top of crane in travel position; ground clearance 0.42m; speed 48km/h; crew 2. The IMR (*inzhenernaia mashina ragrazhdeniia*, engineer obstacle-clearing machine) is based on a T-54/55 chasis with a T-54 engine. It has NBC protection, an infra-red searchlight and vision equipment, and mounts an extendable hydraulic "manipulator", much like a "cherry-picker". It also has an adjustable, hydraulic dozer blade and earth bucket and grab for digging. An unditching beam is mounted at the rear. Although it lacks the demolition gun of Western combat engineer vehicles, the IMR can clear obstacles under fire as well as dig emplacements and perform road repair. The crew of two – driver-mechanic and commander-operator – have a high degree of armour protection.

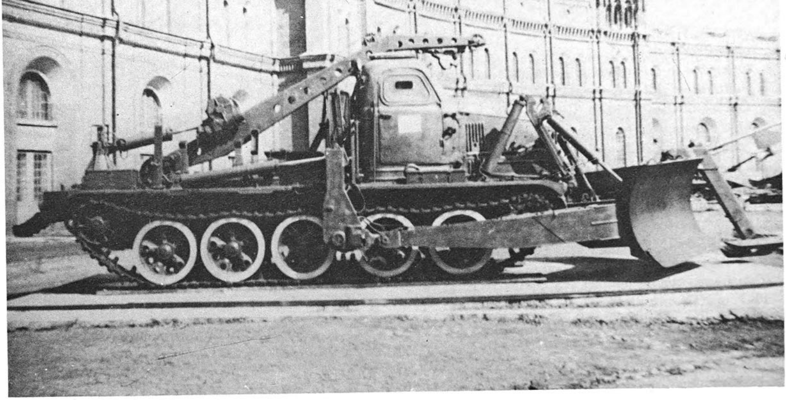


Model of the IPR amphibious engineer vehicle. *(Jane's Armour and Artillery)*

IMR-2 combat engineer vehicle A new version of the IMR, based on the T-72 chassis.

AR-2 river reconnaissance system Sled towed behind an amphibious vehicle or boat and fitted with mechanical devices to check river depth.

IRM/IPR engineer amphibious reconnaissance vehicle Intended for engineer reconnaissance, especially of river crossings. Introduced in the 1980s. Fully submersible and amphibious, with directable cowled propellers, mine detector arms, and a variety of sensors and probes. Has automatic lane-marking capability. Probably has on-vehicle ballast tanks. Chassis derived from 2S1. Can snorkel at depths of up to 11m. Small numbers will probably be added to each divisional engineer battalion and Naval Infantry brigade. IRM engineer reconnaissance vehicle may differ from IPR, in being fitted for



BAT-M in travelling position *(A. Dupouy)*

A PZM-2 regimental digger and ditcher in action. The original PZM is a similar vehicle. *(US Army)*

minefield scouting and, though amphibious, lacking IPR's underwater capability. Both have NBC defence system. **Length** 8.22m **Width** 3.15m **Height** 2.4m **Weight** 17 tonnes **Engine** 300hp diesel **Range** 500km **Speed** 52km/h **Water speed** 10km/h **Armament** 7.62mm PKT

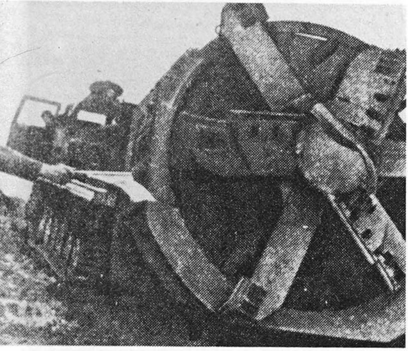
BTM and BTM-3 digger and ditcher Weight 26,500kg (30,000kg for BTM-3); length 7.35m (7.6m for BTM-3) travelling, 10.85m working; width 3.2m; height 4.3m travelling, 3.5m working; ground clearance 0.425m; road speed 35km/h; range 400km; ground pressure 0.71kg/cm²; track 2.64m; track width 0.50m; engine V-401 V-12 water-cooled 415hp diesel; trench crossing 2.1m; crew 2; trench-digging capability 1,120m of 0.8m-deep trench per hour, 500m of 1.6m-deep trench per hour. The BTM-3 can dig 100m of 0.6m trench per hour in frozen ground. Digging is by a wheel of ten buckets. Maximum trench or ditch size: 1.5m deep, 1m wide. Able to move 240m³ of unfrozen or, in the BTM-3, 90m³ of frozen earth per hour. Based on the AT-T artillery tractor chassis, this bizarre-looking vehicle is reported to be unreliable in use.

PZM and PZM-2 digging and ditching machine This regimental-level digging machine digs trenches up to 1.1m deep and weapon or vehicle pits up to 3m deep at a rate of 100m³ per hour, using ladder bucket entrenching. The more powerful PZM-2 is similar. Both have a front-mounted dozer blade.

MDK-2M rotary excavator Weight 27,000kg; length 8m travelling, 10.23m working; width 4.0m; height 3.95m travelling, 3.9m working; ground clearance 0.425m; road speed 35km/h; track 2.64m; track width 0.5m; engine V-401 V-12 water-cooled 415hp diesel; range 400km; ground pressure 0.71kg/cm²; trench 2.1m; vertical obstacle 1.0m; gradient 20°; ford 0.75m. Using its rotary cutter, the MDK-2M can excavate 300m³ of earth per hour to a maximum depth and width of 3.5m. It also mounts an OTT hydraulic dozer blade.

MDK-3 rotary excavator Based on the MT-T tractor chassis, this is a follow-on to the MDK-2M.

E-305V universal single-bucket crane shovel Built on a KrAZ-214 chassis, the E-305V can be used either for



An MDK-3 rotary excavator with its digger ready for action. *(Jane's Defence Weekly)*

digging or as a crane with a 5,000kg lift capacity. It can use its 0.3m³-capacity shovel to dig 50-60m³ per hour to a maximum depth of 4.1m.

MDK-3 rotary excavator Based on the MT-T tractor chassis, this is a follow-on to the MDK-2M.

BAT dozer Weight 25,300kg (26,000 for BAT-M); length 10m; height 2.845m working, 3.5m travelling; width 4.78m; ground clearance 0.425m; road speed 35km/h; cross-country speed 20km/h; range 400km; max slope 30°; vertical obstacle 1m; trench 1.575m; track width 0.5m; track 2.64m; ground pressure 0.65kg/cm²; ford 0.75m; crew 4. Based on the AT-T artillery tractor, the BAT-M version also mounts a 2,000kg-capacity jib crane. Both have a dozer blade, lifted mechanically in the BAT, hydraulically in the BAT-M. A winch has a 20,000kg pull. Work speed is 4-8km/h, and it can move 120-400m³ of earth in an hour. The width of blade sweep is 4.15–4.78m, depending on configuration. It is often used to lay out cross-country tracks, working at a rate of 4–6km/h in bush or light forest and 4–10km/h in snow-covered terrain.

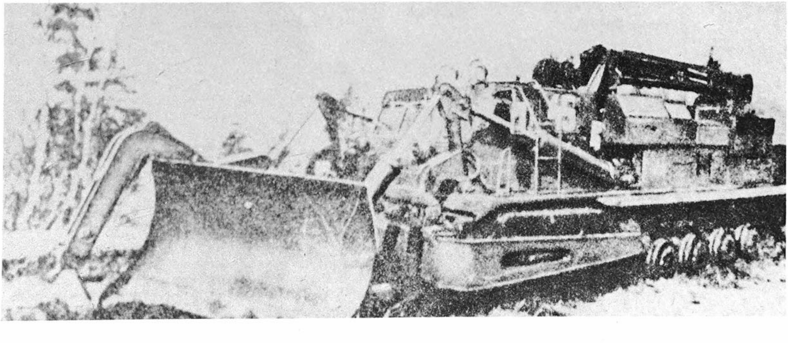
BAT-2 M-1983 dozer Based on the MT-T chassis, this follow-on to the BAT-M has a large dozer blade and a hydraulic crane. Believed to have the same V-46 engine as the T-72.

PKT dozer Length 7.9m; height 3.1m; width 3.2m; road speed 45km/h; cross-country speed 20–25km/h; engine 375hp diesel; weight 21,000kg. Based on the MAZ-538 and mounting a dozer blade, the PKT can move 80–100m³ of earth an hour in either two-bladed or dozer configuration. It can lay tracks across bush or light forest at a rate of 2–3km/h, and across snow-covered territory at a rate of 6–10km/h. It has four-wheel drive.

BTU-55 tank-mounted dozer blade A T-54, 55 or 62 main battle tank fitted with this blade can move 250m³ of earth in an hour and dig three or four tank pits an hour. The STU and STU-2M tank snowploughs are similar.

TUM-100/150 automatic pipelayers Used by the Pipeline Troops, these two semi-trailer-mounted systems are towed by heavy truck and tractor respectively, laying 100mm and 150mm pipe. Operated by front-level pipeline brigades. Working speed 1–3km/h.

BAT-2 dozer. This powerful vehicle is believed to be a substantial advance over the BAT-M. It is shown with dozer blade lowered and on-board crane in travelling position. *(US Army)*



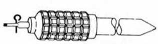
Mines

Type	Structure	Role	Weight (kg)	Dimensions (cm)*	Charge	Force (kg)	Blast radius
YaM-5	wood	AT	7.7	47.5 l × 18.5 w × 8.5 h	3.6–5kg	136	–
TM-57	steel	AT	9.5	29.9 d × 7.4 h	7kg	200–700	–
TMN-46	steel	AT	8.7	31 d × 7.4 h	5.3kg	180	–
KhF-2	metal	gas (mustard)	15	18.5 d × 28 h	4.5 l	–	–
OMZ-3	metal	AP (bounding)	3	6 d × 13.5 h	75g	–	25m
POMZ-2	metal	AP (frag)	2	6 d × 13.5 h	75g	0.5–1.3	4m
PDM-6	–	river bottom	47.5	100 d × 55 h	28kg	–	–
PMD-6	wood	AP (blast)	0.4	20 l × 9 w × 6.5 h	0.2kg	6–28	–
PDM-2	–	river bottom	100+	140h	15kg	4–50	–
YaM-10	wood	AT	11.8	62 l × 21.6 w × 19.6 h	10kg	130	–
TMD-B	wood	AT	7.7	32 l × 28 w × 14 h	5–6.8kg	200	–
TMK-2	metal	AT	12.5	30 d × 35 h	6.5kg	HEAT	–
PDM-1M	–	river bottom	29	100 h	10kg	40–50	–
PDM-2	–	river bottom	100+	140h	15kg	40–50	–
TM-62P	plastic	AT	9.5	32 d × 11.7 h	7.5kg	200–500	–
TMB-2	cardboard	AT	7	27.4 d × 15.5 h	5kg	200	–
PMD-7	wood	AP (blast)	0.3	15 l × 17.5 w × 6.5 h	75g	–	–
PMN	plastic	AP (blast)	0.5	10 d × 55 h	–	1–1.4	–
PFM-1	plastic	blast (surface)	0.074	–	–	5	–
MON-50	plastic	claymore	–	–	1kg	–	–
MON-100	–	directional (frag)	5.0	22 d	2kg	–	100m
MON-200	–	directional (frag)	25.0	52 d	12 kg	–	100m
MON-500	–	directional (frag)	–	–	–	–	100m
PGMDM	plastic	AT (rocket or air-delivered)	1.4–2	6.5 d × 30 h	–	–	–
OTK-10	plastic	AP	–	15 d × 10 h	0.25kg	–	10m

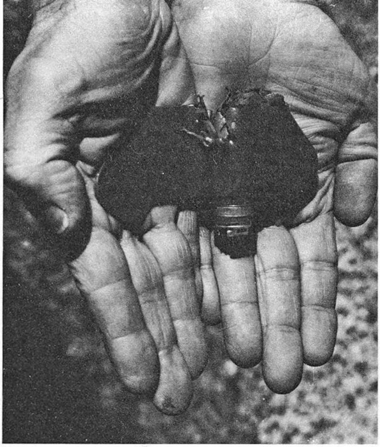
All mines are normally pressure-activated, but can also be command or pull-activated. The gas mine normally uses mustard gas. Force shows the pressure in kilogrammes that must be exerted to detonate the mine. * l = long, w = wide, h = high, d = diameter. Other mines include TM-72 plastic AT, PPM-2 plastic AP, PMP-71 plastic bounding AP.


YaM-5. (*Jane's*)


TMN-46. (*Jane's*)


POMZ-2 anti-personnel stake mine. (*Jane's*)


PMN mine, an improved version of the PM. This mine is used extensively in Afghanistan, both buried and on the surface. Many DRA garrisons are kept from joining the Resistance by well placed minefields. *(David C. Isby)*



Exploded PFM-1 "butterfly" anti-personnel mine. The PFM-1 is used in large numbers in Afghanistan. *(David C. Isby)*

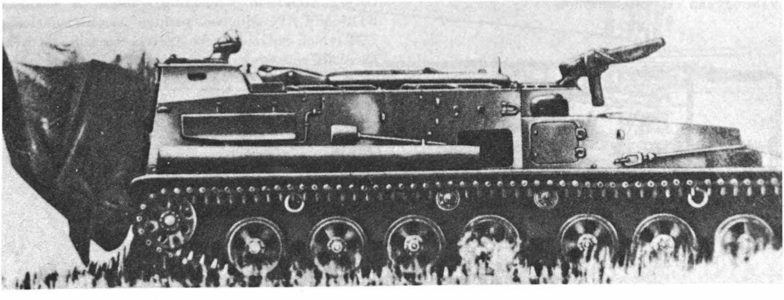
A partially detonated MON-50 directional fragmentation mine recovered from a Soviet perimeter in Afghanistan's Kunar Valley in 1983. It is a copy of the US Claymore. *(David C. Isby)*

Non-contact mines The Afghans report mines with large HE-Frag warheads triggered either acoustically or seismically. These are new-technology systems with a central sensor/battery pack connected to multiple charges 10m+ away.

Minelayers

GMZ armoured minelaying vehicle Length 10.3m with plough lowered, 9.1m with plough raised; width 3.1m; height 2.5m to top of plough; weight 25,000kg; track 2.66m; track width 0.54m; ground contact 5m; road speed 50km/h; gradient 30°; vertical obstacle 1m; engine 500hp water-cooled diesel; armament 14.5mm KPVT; work speed 4–10km/h laying mines on surface, 2–3km/h burying mines; crew 4; minelaying rate 8 surface or 4 buried mines per minute; space between mines 4–5.5m; mine capacity 208 mines (estimated); reload time 12–15min. Has full night vision equipment. GMZs are usually part of the divisional anti-tank reserve. A platoon of three GMZs can lay a three-row 1km minefield in 30min. Used in the Lebanon in 1982. Also designated M-1977.

GMZ tracked minelaying vehicle with its characteristic "tail sting" mine planter covered by a tarpaulin. The 14.5mm machine gun is also covered. In Afghanistan machine guns are mounted on almost every item of Soviet engineer equipment.



PMR-3 (-2) towed mechanical minelayer trailer Usual towing vehicle BTR-152; length 3m; width 2m; height 2.5m; mine spacing 4–5.5m; mine burial depth 30-40cm in soft soil (surface only); capacity 120 mines; reload time 12–15min (15–20); planting chutes 1 (2); crew 4–5 (7); mines laid per minute 10–12; work speed 4–10km/h (3–5km/h) surface, 2–3km/h buried (furrows). Figures in parentheses are for earlier PMR-2 where it differs from the PMR-3. For both systems the capacity varies as follows if the towing vehicle is other than the standard BTR-152: ZIL-157 200, BTR-60 100-130, Ural-375 350, GMZ 180-200. The PMR-3 can plant a 500m buried mine belt in five min. The PMZ-4 towed minelayer is the same as the PMR-3 but with a 200-mine capacity. When used, PMR-3s are part of the regimental anti-tank reserve.

Helicopter minelaying equipment Length 4.8m; width 0.4m; height 0.13m; surface only; mines carried 200+; laying rate 4 per min. Mines are dropped from a chute projecting from the helicopter fuselage. It is used on Mi-4 and Mi-8 helicopters of both the Soviet Air Force and Aeroflot. In addition to larger mines, PFM-1 "butterfly" mines can be dropped from special dispensers mounted on Mi-8s.

Mine detectors

DIM/DIM-3 vehicle-mounted detecting equipment Vehicle operating speed 10km/h, less cross-country; max detection depth 25cm; sweep width 2.2m; crew 2. Usually mounted on a GAZ/UAZ-69/469 jeep, this detector gives an audio alarm and automatically brakes the vehicle when a mine is detected. This system is mounted on T-62s in Afghanistan. The DIM can detect metallic mines only, and has not proved a success in Afghanistan.

VIM-203M/VIM-612 mine detectors Wartime-vintage, can detect metallic mines only at up to 20-30cm depth. Weight 13-14kg, mounted on a pole or rifle stock. VIM-625 and VIM-695 are similar.

UMIV/UMIN portable mine detector Post-war man-portable mine detector. Weighs 6.6kg, 45cm detection depth, examines 3m path.

IMP portable mine detector An improved, recent, transistorised design, capable of detecting metallic fuzes in plastic mines. Weighs 7.2kg, detection range of 0.3–0.46m, like others is battery-powered and mounted on a pole with a detector head. Audio alarm. US Army evaluation of the IMP suggests that it is of limited effectiveness, even at close range and without background interference.

Helicopter mine detector A detector head can be lowered from a low-flying helicopter as part of an engineer reconnaissance mission.

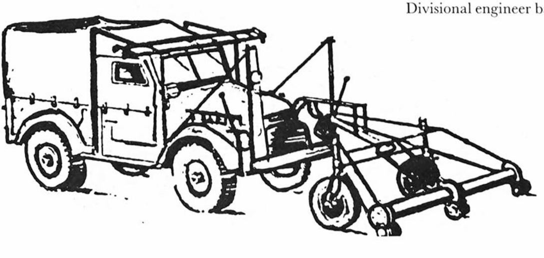
Mine-sniffer dogs Used extensively in Afghanistan against non-metallic mines. Not suited to mobile warfare as dogs suffer from heat, travel sickness and engine fumes.

Mineclearing equipment

M-1987/1 and M-1987/2 mineclearing tanks (designations uncertain)
M-1987/1 is a converted IT-1 or turretless T-55, using new "sheep's foot" mine roller and armed with pintle-mounted NSVT HMG. M-1987/2 is a converted IT-122, using KMT-5 and armed with turret-mounted KPVT HMG. Both used in Afghanistan.

UR-77 M-1979 minefield breaching vehicle This vehicle has the same chassis as the 2S1 SP howitzer. Its turret-like superstructure mounts three rockets, each towing 170m of line explosive charge to a maximum range of 200-400m. Entered service in about 1981-2 as a follow-on to the UR-67. Its main mission is mine clearance, and it is fitted with a dozer blade or mine roller or plough of unspecified design.

UR-67 minefield breaching vehicle A modified BTR-50PK APC with two "bathtub" mounts containing UZR-3 high-explosive line charge rockets on the rear deck. Divisional engineer battalions have two to six each.

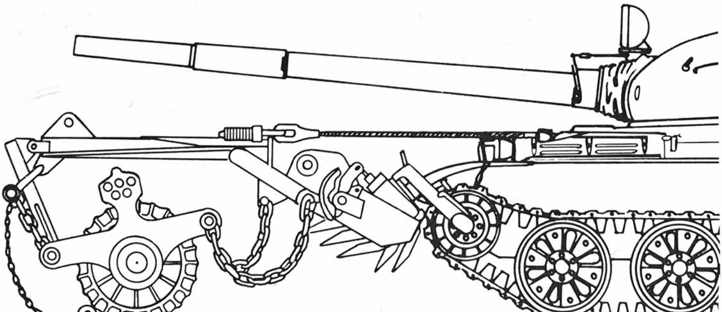


DIM vehicle-mounted mine detector on a GAZ-69.

Two UR-77 mineclearing vehicles, with rockets for propelling line charges elevated on their launch racks. In the background, a UR-67 mineclearing vehicle—based on the BTR-50—fires its rocket-propelled line charge. *(US Army)*

KMT tank-mounted mine roller and/or plough
Weight 7,500kg; width of swept lane 0.73–0.81m per roller; operating speed 8–12km/h; attachment time 10–20 min; assembly length 3.18m; assembly width 4m; width of unswept lane 2.1m; plough and roller depth effectiveness 0.35m. The KMT-4/5 combination roller and plough can be mounted on any Soviet main battle tank. With three roller sections and a lane-marking plough, it can survive eight to ten 5-6kg explosions. At night it can be fitted to mark the cleared lanes with luminous tape. When not in use it is carried in a 7.5-tonne cargo truck with a KM-61 crane, such as the KrAZ-214. The KMT-4 element is the plough, lowered by a hydraulic ram, which pushes the mines out of the tank's way rather than detonating them. The rollers are improved, lighter versions of those used in the PT-54/55 system. A weighted chain hangs between the forward roller assemblies to detonate tilt-fuzed mines. The KMT-4 (the plough component) and KMT-5 (the roller component) can be used independently. The improved KMT-5M introduced night-marking capability, and the

KMT-4/5 roller-plough set. *(US Army)*



KMT-4M had improvements to the blade attachment system. An improved late-1960s version of the KMT-4M is designated KMT-6; this is usually fitted to T-64s in preference to the KMT-5. T-72s and T-62s have also carried the KMT-6.

PT-54/55 mine-clearing rollers Tank-mounted mine-clearing rollers, each of two independent roller sets mounted on arms in front of each tread, clearing a path ahead of each one. The gap between the treads remains uncleared. It can survive ten anti-tank mines, takes 10–15min to attach and 3–5min to detach. It is used at speeds of 8–12km/h, and the swept lane for each tread is 0.8–1.3m wide. The PT-54 has six rollers a side, the PT-54M five, the PT-55 four. The PT-54 weighs 8.8 tons, the PT-55 6.7 tons. They cannot detonate modern mines with more sophisticated fuzing.

SPZ-2 and SPZ-4 mine-clearance charges The metal-framed SPZ-2 is connected to a cable with an anchor attached to one end. The anchor is fired across a minefield and the charges are winched across at a rate of 200m/h, then detonated. The SPZ-4 is pushed into a minefield by a tank at a rate of 100m/h, or it is laid behind a tank in the gap between the cleared path left by the mine rollers and then detonated.

BDT mine-clearing charge A light metal tube, 50mm in diameter, maximum length 500m (which takes 90min to assemble). It can contain either a single, double or triple charge. It is pushed into a minefield and detonated. A triple charge will clear a 6m path.

ITB-2 A rocket-launched cable-and-anchor system that uses a winch or other motive power to draw the charge towards the anchor and into the minefield, where it is detonated.

UZ-1 Bangalore torpedo A standard weapon. Each section is 2.1m long and clears a 2.5–3m passage. Single-section charges can also be used. 2.65kg explosive per metre.

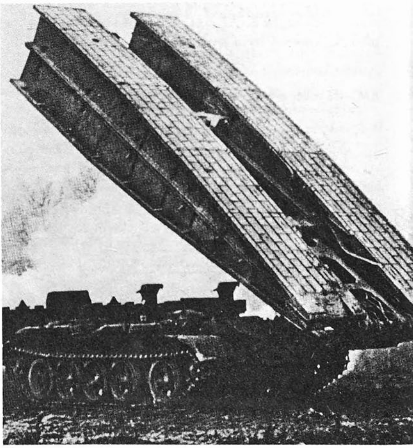
UZ-2 A double-charge line explosive used in 300m and 500m lengths.

UZR-3 A triple-charge Bangalore torpedo with propulsive rockets attached, used in 500m lengths.

Rocket-propelled tube charges Mounted on the left and right rear of tanks or BTR-50PK engineer APCs. Rockets (similar to Swatter ATGMs) carry flexible tubes (in 170m lengths) forward into a minefield, where they can be detonated. The rockets are reported to be unreliable. The six UR-67s (based on BTR-50PK chassis) or UR-77s of the divisional engineer battalion will be deployed well forward, each with at least two of these charges. Each hose can create a breach 180m long and 6–8m wide which can be widened by plough-equipped tanks or engineer vehicles.

Tank-mounted bridges

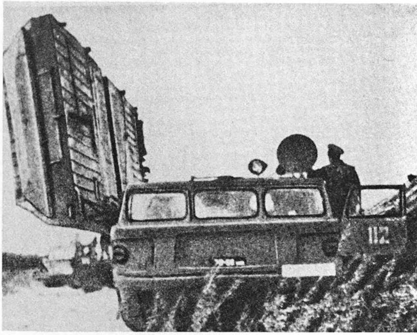
MTU-1 Introduced in 1957. A cantilever-type bridge on a T-54 chassis. Carrying capacity 50 tonnes; span length 12.3m, able to span an 11m gap; emplacement time 3–5min; bridge width 3.274m; crew 2; total weight 34,000kg. Bridge hydraulically launched and recovered.
MTU-20 Introduced in 1967, a cantilever-type bridge on a T-55 chassis. Carrying capacity 50 tonnes, possibly 60 tonnes; span length 20m, able to bridge an 18m gap; emplacement time 5min; total weight 37,000kg; crew 2; bridge width 3.5m. The ends of the MTU-20 fold inwards for travelling and are extended by a simple chain drive. The tank regiment's four MTU-3s, MTU-20s or MT-55s are deployed one per battalion and one in reserve. The two in the motorised rifle regiment go with first-echelon battalions or the advance guard.
MT-55 A Czech-designed scissors bridge on a T-55 chassis. Emplacement time 2–3min; span 18m, good for 16m gap; time to recover bridge 5–6min; carrying capacity 50 tonnes; crew 2; bridge weight 6,500kg; total weight 36,000kg. Equipped with a gap-measuring device, inclinometer, snorkel, full night vision and NBC equipment. One of the few items of Warsaw Pact-designed equipment adopted by the Soviet Army. MTU-3 is similar.


MT-55 raises its bridge for deployment.

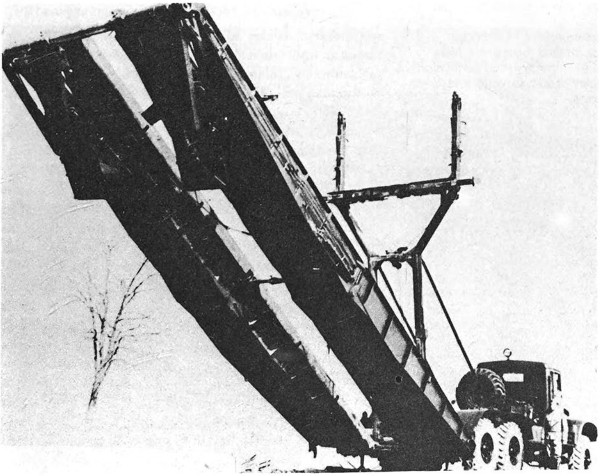
MTU-3 1970s Soviet-designed scissors bridge using the T-55 chassis. Similar to the MT-55.
New bridging tank A scissors bridge mounted on the T-72 chassis is reported to be in production.

Engineer bridges

ABS A new SP bridging system. Wheeled (ABS-W) and tracked (ABS-T) versions produced. For travelling each unit carries its roadway folded on top. To deploy, the unit is driven into the water and the roadway unfolded and rotated 90°. Units can also act as ferries and be connected to other units. Probably used at army or front level. Length 12m, width 3m, height 3.3m.
TMM (*tiazhyolyi mekhanizirovanny most,* heavy truck-mounted bridge). Truck-launched tactical fixed bridge. Carrying capacity 60 tonnes; length: a set consists of four 10.2m sections with 3m adjustable trestles, a total length of 40m; construction time: assembling a single section takes three men 8–15min, while with the full 12-man crew a 40m bridge takes 45–60min by day, 60–80min by night; maximum water depth bridged 3m; launch vehicle KrAZ-214 or KrAZ-255B; roadway width 3.8m; removal time: some as erection time; weight 7,000kg/segment. Trestles are integral with spans. May also be erected underwater. Some of a division's TMMs will be forward. The remainder will be in reserve, where they can replace MT-55s, allowing the latter to follow the first echelon.
KMM (*koleino-mekhanizirovannyi most,* truck-mounted treadway bridge) Obsolescent, largely replaced by the TMM. Carrying capacity 15 tonnes; length 5 × 7m spans, a total of 35m; construction time 30–60min during the day, 60–80 min at night, with full crew of 15 men; launch vehicle ZIL-157 (hydraulically launched); maximum river depth 3m; max vehicle speed while crossing: wheeled 12–20km/h, tracked 1km/h, must have at least 15m spacing; width of roadway 2.95m; weight of segment 1,420kg. The four trestle legs are adjustable in height. The KMM may be recovered in the same way as it was constructed and may also be built underwater.



Above ABS-W bridging unit—roughly comparable to the French Gillois or the German M2—unfolds its pontoons. Standard version is tracked, based on MT-T chassis; wheeled version has ZIL-135 components.



TMM truck-mounted scissors bridge being lowered into position.

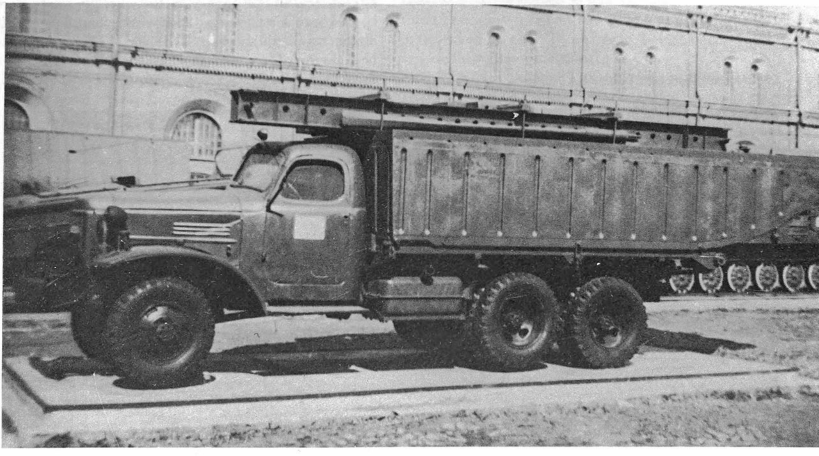
A battery of 122mm SP howitzers crosses a PMP bridge. Boats stand by to hold the bridge against the current. Note the steep banks and absence of a temporary road surface on the banks, showing the capabilities of both vehicles and bridge. *(US Department of Defence)*

PMP pontoon bridge *(pontonno-mostovoi park*, pontoon bridge set) The standard Soviet tactical bridge. The basic PMP pontoon link section, which can be used as a ferry or inserted in a bridge, consists of four hinged accordion-folded pontoon sections with an integral roadway. These automatically unfold as soon as they hit the water, and the crews have only to join the sections together. The full 36-link (32 river links, 4 shore links) set may be set up as bridges or rafts. Divisions usually have half a PMP set with 16 river and two shore links, and 6 boats. This allows them to construct 118m of 60-tonne bridge, 225m of 20-tonne bridge, or two 170-tonne, three 110-tonne, four 80-tonne or five or six 60-tonne rafts. Maximum current 3m/sec with bow shields, 2m/sec without; assembly rates 7m/min, a total of 50min for a whole set and 30min for a half (divisional) set with a working party of 70–80 men. The split-pontoon bridge with a 20-tonne capacity takes the same amount of time. Construction time for rafts: 40-tonne (2 pontoons) 8min, 60-tonne (3 pontoons) 10min, 80-tonne (4 pontoons) 12min, 110-tonne (5 pontoons + 1 shore section) 15min, 170-tonne (8 pontoons + 1 shore section) 20min. Ferry passage width 6.5m; roadway width 6.5m; maximum speed of armour on bridge 30km/h; recovery time; double the construction time.

TPP *(tiazhyolyi pontonno-mostovoi park*, heavy pontoon bridge set) Largely replaced by the PMP, the TPP system consists of bow and centre sections of rigid metal pontoons with an integral roadway superstructure, transported on ZIL-151/157 trucks. A full TPP set includes 48 bow sections, 48 centre sections, 12 BMK-150 powerboats and auxiliary equipment. It may also be configured as ferries rather than a bridge. Capacity: up to 70 tonnes, depending on length; maximum current 4m/sec; length of assemblies 6m bow, 4.9m centre section; length: using an entire set, a 16-tonne-capacity bridge can be 335m (333) long, a 50-tonne-capacity bridge can be up to 265m long, and a 70-tonne-capacity bridge can be up to 205m (185) long. For a half set, the lengths are 163m (148), 135m (133) and 103m (93) respectively, and 77m, 73m and 58m (52) for a

BMK-T powerboat mounted on a KrAZ-255B of the East German Army. The BMK-T works with PMP bridging equipment, using its broad, flat bow to push the sections into place. The BMK-T is also used to power PMP sections when they are employed as ferries. (*V.M. Martinova*)

TPP heavy bridge pontoon on ZIL-151. (*A. Dupouy*)



quarter set. 16-tonne-capacity bridges can have their length extended by use of local materials to 506m (404), 258m (203) and 133m (108) for full, half and quarter sets. The 16-tonne bridge requires 2½hrs (4), the 50-tonne bridge requires 2hrs (2½), the 70-tonne bridge requires 3hrs working time with 384 men in daylight. Night building takes 50–100% longer. Figures in parentheses are used when current is over 1.5m/sec. Roadway width 3.2m for 16-tonne version, 4.0m for others. There are two pontoon sections per support. When used as a ferry, capacity is 50 tonnes.

LPP light pontoon bridge Carrying capacity 12/24/40 tonnes, depending on length (160/88/64m respectively); building time 50–60min with 105 men. Similar to a lightened TPP, carried on GAZ-63s. It can be used in 24-tonne and 40-tonne-capacity rafts. No longer in extensive front-line Soviet service, it is used where weight makes the use of PMP impractical. Limited to maximum stream velocity of 2m/sec.

PVD-20 airborne pontoon bridge This is used by the engineer battalions of airborne divisions, and can be air-dropped or heli-lifted. Total weight 13 tonnes; ground transport 10 GAZ-66 or 6 ZIL-157; length 64m for 8-tonne capacity, 88.2m for 4-6-tonne capacity; time to build 50min. Uses pneumatic boats as pontoons. Can also be built as 4, 6 or 8-tonne-capacity rafts.

DPP-40 airborne pontoon bridge Follow-on to the PVD-20, using pneumatic boats as pontoons or rafts. Probably has higher capacity than PVD-20.

MARM sectional bridge Used on lines of communication. 50-tonne capacity, built at a rate of 20m per hour, 6m length per span. Can also be used as overpass at busy roads.

SARM sectional bridge Used on lines of communication. Truss bridge, usually 158m long but can be longer. Construction speed 20m per hour. Panel-type crib piers provide support. Truss sections 6m long, 1.5m wide, 2m high are carried in semitrailers behind MAZ-504s or ZIL-130Vs. If the bridge is constructed low to the water, panel-type crib piers can also be used.

NZh-56 floating railway bridge Used on lines of communication. 150-tonne capacity. Maximum length 200m or more. Pontoons are transported on KrAZ-214. Railway can be either Soviet or European gauge. Used by Railway Troops, not by Engineers. Other types of lines of communication bridges are also used by Road and Railway troops.

Metal roadlaying equipment Normally mounted on KrAZ-214 and PTS-2, this flexible steel matting is laid out with the truck in reverse. Each truck carries 38m of road.

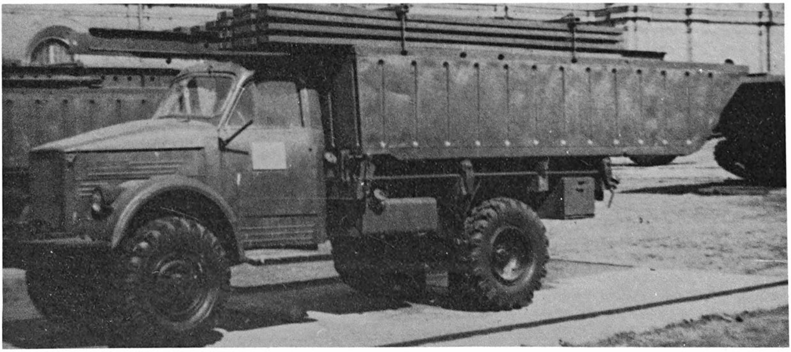
Suspension bridges There are three types of suspension bridge for use in mountainous country: the PVM 120m footbridge, LVM 80m 2-tonne-capacity and the TVM 60m 10-tonne-capacity bridges.

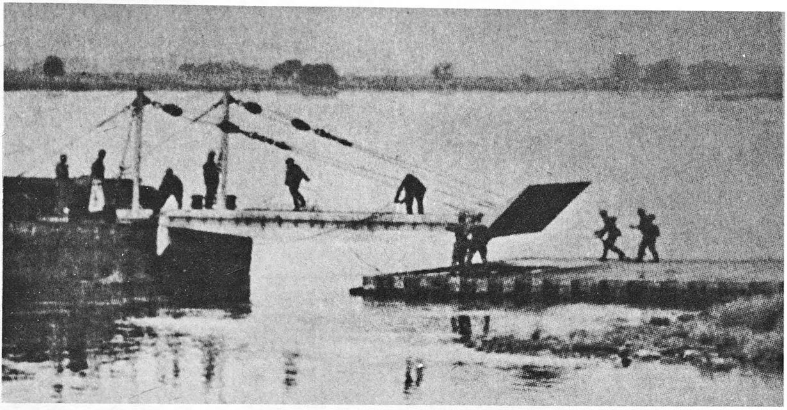
Underwater pontoon bridge Many Soviet bridges can be erected under water, but there is one specific underwater type. This is similar to a scaled-down PMP carried on ZIL-131s. Each pontoon is about 8m long and 3m wide; bridge capacity is 25–30 tonnes. Positioning underwater is achieved by flooding the pontoons until they rest on the river bottom or on steel supports.

Prefabricated wooden bridges With 12, 40 and 60-tonne capacities, the bridges are used to replace destroyed spans in wartime. The steel RMM-4 is similar.

Prefabricated temporary railway bridge parts Can be used to repair a damaged span within 96hrs if piers and abutments are still standing. If the piers or abutments have been destroyed, reconstruction time will be at least four times longer. Prepositioned in eastern Europe.

LPP pontoon section carried on GAZ-63 truck. (*A. Dupouy*)





Bow ramp of a bridge of barges being attached to a landing. Barge bridges can handle both road and rail traffic. *(US Department of Defence)*

REM-500 railway and road bridge Used on lines of communication. Can carry both rail and road traffic. REMs come in both Soviet and standard railway gauge. Maximum depth 7m, maximum current 1.2m/sec. A flatcar-mounted gantry is used for assembly. Capacity 20 tonnes axle-load. Polish equivalent is DMS-65.

SP-19 self-propelled pontoon bridge Rail and road sections mounted on standard motorised barges, with a maximum capacity of 180 tonnes as a bridge and 100 tonnes as a five-pontoon raft; the latter is the most probable mode of employment. Each barge has an estimated capacity of three loaded Soviet railway wagons. Used on lines of communication and held in reserve.

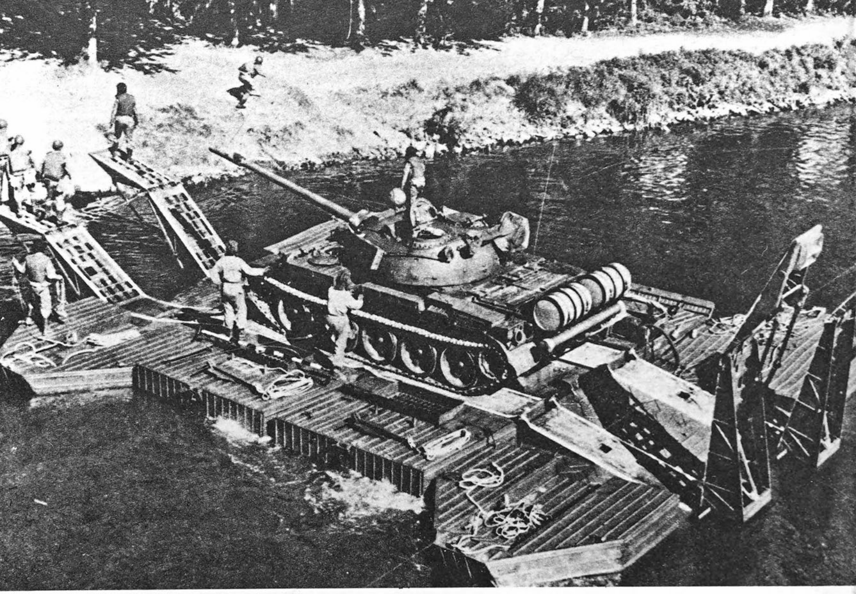
Heavy barge bridges The Soviets have many methods of using standard Eastern European river barges as pontoons for road and railway bridges. Most bridges built in this manner would require 12–30 hours to construct. Seven 600-tonne barges, spanning a 400m river, would require 24hrs to emplace.

Amphibious vehicles and ferries

GSP amphibious ferry Carrying capacity 50 tonnes; maximum current in which it can be used 2m/sec; time to ready for operation 3–5min with six-man assembly crew; length 12m; width 3.24m (per half unit); height 3.2m; track width 0.36m; engine: YaMz-M204VKR 4-cylinder in-line water-cooled 135hp diesel; water propulsion 4 propellers (in complete ferry); maximum road speed 40km/h; maximum water speed 7.7km/h; minimum draught 1.2m; maximum height of river bank 0.5m; crew 3. The GSP (*gusenichnii samokhodnii porom*, tracked self-propelled ferry) consists of two non-interchangeable left and right half units with large foam-filled outer pontoons. Carried on top of the vehicle, the pontoons are rotated outwards when the two ferry halves are connected in the water. The GSP is capable of ferrying tanks, which can fire their guns while afloat.

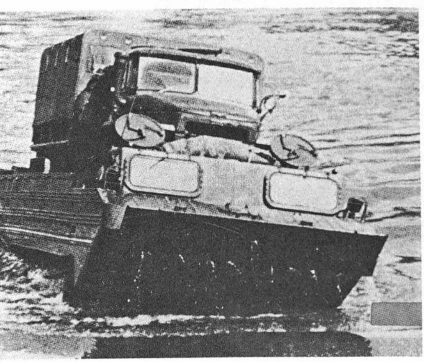
PTS/PTS-M tracked amphibious transporter Weight (empty 17,000kg; length 11.6m; width 3.5m; height 3.4m cab, 2.9m bows; crew 2; track 2.9m; clearance 0.5m; track width 0.5m; cruise range 300km land, 100-110km water; ground pressure 0.32kg/cm^2 empty, 0.41kg/cm^2 loaded; trench crossing 3.6m; gradient 30°, exit gradient from water, loaded 25°; suspension: torsion bar, six road wheels; load area 7.9 × 2.6m; track on ground 5.63m; trailer used: PKP; payload 5,000kg land, 10,000kg water; passengers 70; engine: A-712P V-12 water-cooled 250hp diesel in PTS, V-54P V-12 water-cooled 350hp diesel in PTS-M. Speed 40km/h land, 10km/h water (15km/h for PTS-M). PTS-M has infra-red searchlight and driving lights and a fully sealable cab. Designated medium amphibious transporter (*plavaiushchii transportr srednii*, PTS).

PTS-2 tracked amphibious transporter A follow-on to the PTS-M, the PTS-2 is based on the MT-T heavy tractor. Payload 5 tonnes land, 10 tonnes water; length 7.9m; width 2.6m. Introduced late 1970s.



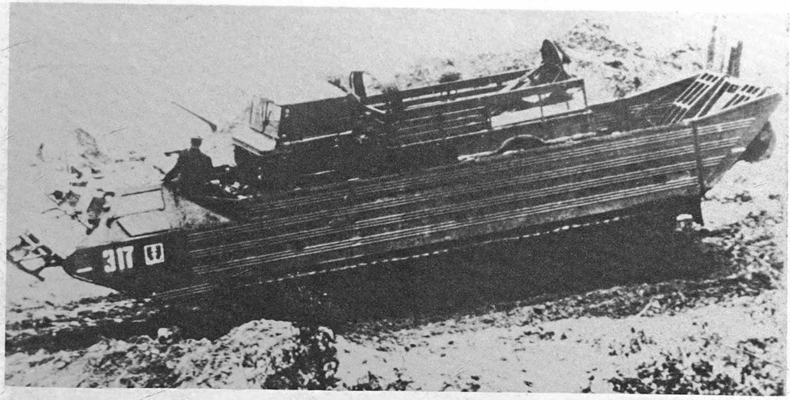
GSP amphibious ferry – with two sections joined together – carrying a T-55. (*US Army*)

PTS-M amphibian carrying a Ural-375. (*US Army*)



K-61 tracked amphibious transporter Weight 9,550kg empty; length 9.15m; width 3.15m; height 2.15m; track 2.6m; crew 3; clearance 0.36m loaded, 0.4m unloaded; track width 0.3m; length of track on ground 4.56m; ground pressure 0.36kg/cm^2 empty, 0.45kg/cm^2 loaded; trench 3.0m; vertical obstacle 0.65m; gradient 42° empty, 25° loaded, 20° river bank exit gradient; fuel capacity 260 litres; fuel consumption 0.95 litres/km; payload 3,000kg land, 5,000kg water; passengers 50; speed 36km/h land, 10km/h water; water propulsion: two propellers; range 260km land, 64km water; engine: YaAZ-M204 VKR 135hp 2-stroke 4-cylinder in-line diesel. The K-61 can carry all but the largest towed artillery with their towing vehicles. Also referred to as the GPT (*gusenichnii plavaiushchii transportr*, tracked amphibious transporter), it is being supplanted by the PTS/PTS-2.

ZIL-485 BAV Weight 7,150kg; length 9.54m; width 2.845m; height 2.66m; crew 2; engine: ZIL-123 (or ZIL-157K) 6-cylinder 110hp water-cooled petrol; water propulsion: one 3-bladed propeller; range 460km land, 48km water; wheelbase 3.668 + 1.120m; track 1.62m; clearance 0.28m; tyre size 11 × 18 (12 × 18 in BAV-A); trench crossing 0.6m; vertical obstacle 0.4m (0.6m in BAV-A); gradient 30°; fuel capacity 240 litres; maximum load 2,500kg; passengers 28; armament 12.7mm DshKM. The central tyre pressure regulation system has internal air



PTS-2 carrying a GAZ-66 truck. The PTS-2 has an armoured cab.

K-61 amphibian of the East German Army. (*US Army*)

lines in the BAV-A, external air lines in the later version. The BAV (*bol'shoi plavaiushchii avtomobili*, large amphibious truck) is an improved version of the US wartime DUKW. It has been almost completely replaced by the K-61.

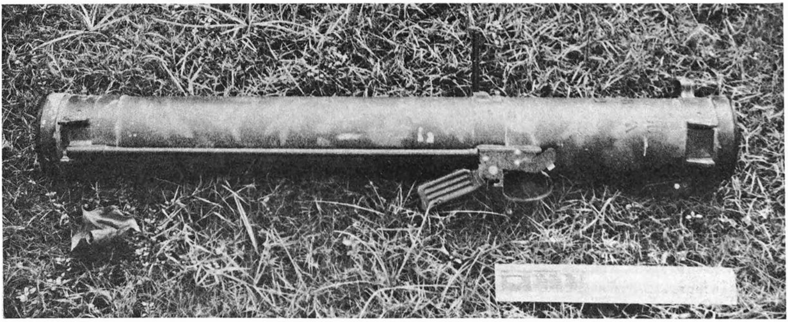
BAV amphibian carrying a 76.2mm field gun. (*US Army*)

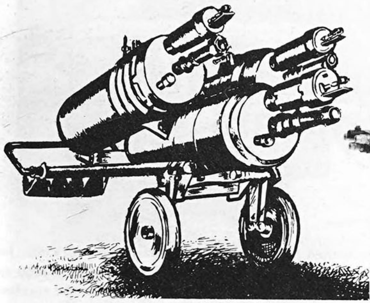
Flamethrowers

Soviet sapper sub-units are trained in flamethrower use. Assault engineer regiments – formations about which little is known – are believed to use many flamethrowers. The Soviets emphasise the use of flame weapons in urban combat. The RPO and RPO-A have had significant effect in mountain fighting in Afghanistan. The RPO-A and possibly the RPO may be used by non-engineer troops.

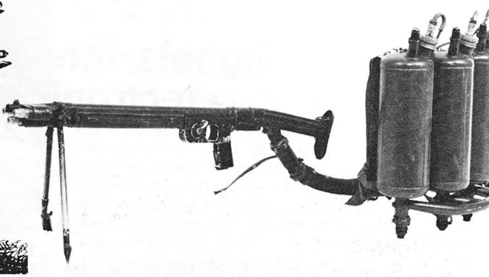
RPO flame grenade launcher Supplanting the LPO-50, the RPO fires a rocket-assisted flame grenade. Used in Afghanistan. RPO and RPO-A deliver a larger charge at

Camouflage-painted RPO-A captured by the Afghan Resistance. (*Afghan Information and Documentation Centre)*





TPO-50 cart-mounted flamethrower.



LPO-50 manpack flamethrower. (*US Army*)

longer range than a standard flamethrower. Maximum range 400m; effective range 190m; launcher weight 3.5kg; launcher length 1.44m; burst area 30-40m × 3-4m; rate of fire 1rpm; unit of fire 2 rounds; crew 1.

RPO-A flame rocket launcher Disposable, single-shot weapon similar to the RPG-18. Used in Afghanistan. Effective range 1,000m; launcher length 0.92m; warhead weight 2.2kg.

LPO-50 light flamethrower Standard Soviet man-carried flamethrower, heavily used in urban combat. Used in Vietnam. Range 50-70m; compound capacity: enough for six blasts; tanks: three; chances of hitting vehicle or building with LPO-50 blasts: 97% at 25m, 81% at 50m.

TPO-50 heavy flamethrower Cart-mounted with three fuel tanks. Capable of firing thickened fuel to 180m and unthickened fuel to 65m. Ignition, like the LPO-50, is by battery. Weight is 170kg.

Tank-mounted flamethrowers Still in service in the Soviet Army, unlike those of Britain or the USA. Found in special engineer units, and used mainly for direct support of motorised rifle units in urban combat and when attacking fortifications. A platoon of flamethrower tanks is used with a motorised rifle battalion. Flamethrowers are usually mounted in T-55 tanks (designated TO-55) – although a flamethrower T-62 has been reported – in place of the co-axial machine gun. The flamethrower, designated the ATO-200, is of revolver design and has enough charges to fire 12 bursts of flame. A total of 460 litres of fuel is carried, 35 litres being used in each burst. Maximum range 200m; maximum rate of fire 7 bursts per minute.

Inflatable boats

	NL-5	NL-8	NDL-10	NL-15	NDL-20	NL-30
Weight	50kg	55kg	80kg	95kg	150kg	200kg
Length	3.2m	—	5m	—	6m	—
Capacity (men)	5	8	15	15	27	30
Capacity (cargo)	700kg	650kg	1,500kg	1,500kg	2,510kg	3,400kg

Folding assault boats

	MSL	DSL	DL-10 (half-size)	DL-10 (full size)
Weight	65kg	180kg	170kg	420kg
Length	3.2m	5.5m	4.2m	8.6m
Capacity (men)	4	14	15	25
Capacity (cargo)	400kg	1,500kg	1,500kg	3,000kg

Chapter Nineteen

Signals, intelligence and electronic warfare

Signals

The Soviets use high-frequency, very-high-frequency, and ultra-high-frequency radios for tactical communications. Specialised signals units exist at all levels from front (brigades) to battalions (platoons). Although the radio designs differ, their frequency ranges and general use are similar to those of NATO systems. Compared to those of Western armies, however, Soviet radio communications are less elaborate and thorough.

The primary means of tactical command and control is very-high-frequency radio; high-frequency radio, both voice and teletypewriter, is also used. Highly directional ultra-high-frequency radios are employed for command and control at higher echelons, particularly the transmission of large volumes of data to command posts at the planning level. Although not as sophisticated as current US systems, Soviet UHF radios are similar in frequency range and general use.

The use of radios with frequency ranges similar to those employed by NATO has the incidental effect of jamming NATO communications, while requiring the Soviets to use directional antennae within their own networks. In a deliberate attack, the Soviets will try to observe radio listening silence while barrage-jamming enemy communications.

The Soviets have no secure-voice capability below regiment level, relying instead on "home-made" codes; examples of these unsophisticated grid ciphers have been captured in Afghanistan. Because they do not have automated frequency-management and code production and distribution, Soviet battalions might have to operate on the same frequencies for several days.

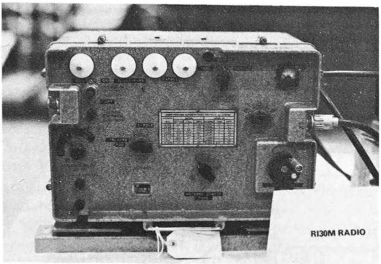
The Soviets strive for strict radio discipline. In the defence they communicate by wire whenever possible, with wire networks being laid along major routes of advance. Personal contact is also stressed: battalion commanders will try to visit each company HQ during a halt on the march. The use of signal flags by tactical units is stressed. In the offence, listening silence is maintained – with microphones disconnected to avoid accidental transmission – until the start of battle, when those authorised to transmit may do so without restriction. In the meeting engagement, radio silence is lifted as soon as any element of the Soviet force, other than the combat reconnaissance patrol, makes contact.

Much of the rigidity associated with Second World War Soviet tactics was due to a shortage of radios and lack of effective battlefield communications. Security was also a weakness: radio intercepts were often the prime source of German tactical intelligence. On a battlefield in which electronic communications may be among the first casualties, the Soviets are better equipped than NATO to operate with alternative means. On the defence, wire communication is used whenever possible, with 100m lengths of battle cable connected to link switchboards. A single battalion network averages 10–12km of cable. At regiment and higher levels, UHF and VHF relay systems will be set up.

The Soviets will make extensive use of dummy and deceptive radio nets to confuse enemy electronic support measures, as was seen in the 1968 invasion of Czechoslovakia. The activation of Soviet tactical radio networks is seen as a key indicator of offensive action. A division will have not only to test its radios but also to get them all "on net" before moving out, a process which can take 24hrs and so will be subjected to elaborate concealment measures.

Although the Soviets still make much use of messengers and employ reliable wire communications systems whenever possible, they realise that any army must rely on radio communications in modern war. Soviet radios are rugged, moisture-proof, simple and effective, and frequency coverage and overlap are adequate. While they lack the technological refinement of their Western counterparts, they have a generally low failure rate and are easy to use and maintain. Most, however, use vacuum tubes and are large and bulky, and so are confined to vehicle mounts. The exception is the R-126, a small, lightweight FM transceiver with limited range and frequency, and its more modern replacement.

In the 1970s the Soviets started introducing a series of improved radios. But even these systems – in use from subunit level up to army/front – are less sophisticated than



R-130M radio. *(David C. Isby)*

their Western equivalents. Examples include the R-130, R-148 and R-392A. The subsequent acquisition of Western technology means that the Soviets will be able to modernise their troop radios in the late 1980s; the provision of secure voice capability and advanced high-level communications may prove more difficult.

The way Soviet radios are used is as important as their technical characteristics. As in all armies, the radios function in networks, and only radios on the same network can communicate with each other. Special networks exist for NBC warnings, air defence, artillery and communication with the Air Force. The Soviet insistence on strict radio discipline allows a battalion to use one network for all three companies if required, although separate company networks are also used. The R-123M set found in almost all Soviet AFVs is normally set to the "receive only" mode in all except company and higher-level command vehicles, although this can be altered if the situation requires it.

The strict Soviet network structure does have some disadvantages. A motorised rifle company commander could not normally communicate with his own battalion's mortar platoon, anti-tank platoon or maintenance section, or with an artillery battery if one were attached to the battalion. He would only be "netted in" to the other company commanders, his nine subordinate vehicles, and the battalion commander and chief of staff. A message to the anti-tank platoon requesting help or reporting a target would have to be relayed through the battalion commander or chief of staff. If company networks are used, a separate fire-support network would allow direct communication. In some cases, however, the Soviets have procedures which make it possible to skip echelons in communications. Passing the word is time-consuming. Using NATO double-callsign procedures, the standard time for the passage of a short message is three minutes per radio network. Minimising the number of different networks a message must pass over reduces the time lag.

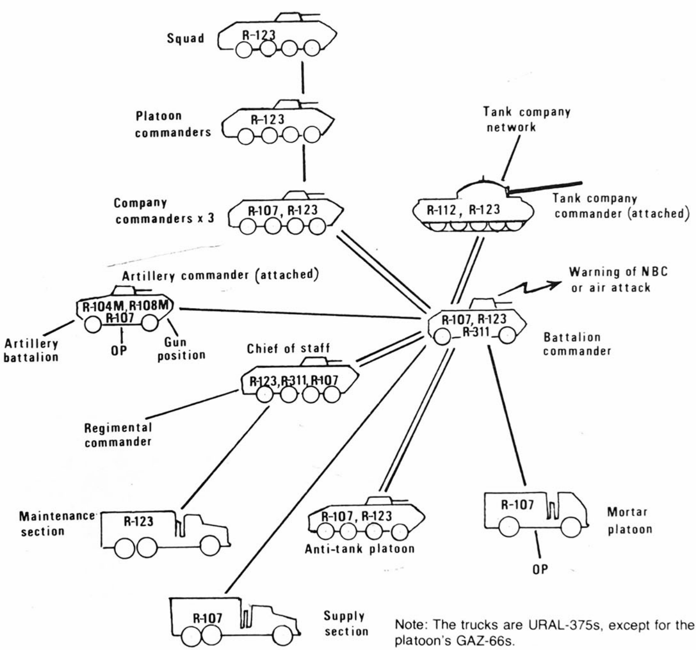
The four manoeuvre companies of a motorised rifle battalion will usually be netted in together on a single radio network with battalion HQ, using the R-123 set. Thus anything broadcast in any one of 30 APCs or 13 tanks will be heard by every other one, requiring strict radio discipline. Alternatively, the battalion commander can give orders to just the four company commanders by using the R-107 set, which is also netted in to the tank company command tanks' R-112 set. If the companies are not operating as part of a complete battalion, each company will have its own radio network and will only receive or send within its own company, except, of course, for the company commander. By comparison, a US tank company operates no fewer than four internal radio networks, plus a fifth connecting it with battalion. Soviet platoon and even company commanders will use hand and flare signals whenever possible, this being made easier by the tight Soviet tactical formations. Individual tanks broadcast only in an emergency. Tactical messages are in clear voice. Reduced radio traffic increases security, reduces vulnerability to RDF and jamming, reduces the total number of frequencies required, and reduces interference. But it also contributes to tactical inflexibility.

The General Staff's Communications Directorate runs its communications network. This has redundant and parallel links, and is not fully activated until mobilisation. The KGB has an independent communications network that connects KGB headquarters in Moscow with its subordinates, and may duplicate that of the General Staff; this network may also be used for nuclear weapons-related messages. The KGB's Department of State Communications maintains the non-military Soviet Government communications systems. In addition, each service main staff has an independent network linking it with the field units. The Ministry of Defence is connected directly with GTVDs and military districts, which are linked with their subordinate units. All of these networks incorporate skip-echelon communications and are designed so that links can survive the loss of an intermediate headquarters.

Long-range communications include secure landlines, ELF, LF/VLF, HF, troposcatter, VHF and UHF systems. In addition, army staffs have access to the eight-unit Molniya 1 and Molniya 2 and four-unit Molniya 3 multi-purpose (imagery and communications) satellite constellations, as well as the Raduga, Gorizont, Loutch and Ekran communications satellite systems. The 11-satellite geosynchronous Gorizont is used for civil communications in peacetime and supports the 500-station Moskva network in the Soviet Union. The geosynchronous Ekran is usually used for television broadcasting and the nine-satellite geosynchronous Loutch includes stations in Cuba and Mongolia. Raduga and the projected Volna system are also geosynchronous.

Operational headquarters – including that in Kabul –

TYPICAL MOTORISED RIFLE RADIO NETWORK



Note: The trucks are URAL-375s, except for the mortar platoon's GAZ-66s.

have Lolos ground stations. A satellite communications system called Askold and characterised by five tall vertical aerials is reported to be used by some headquarters. There are also two or possibly three low-altitude communications constellations which seem to be used mainly for reconnaissance and naval duties. It is likely that operational headquarters will have real-time access to reconnaissance satellite information, perhaps in the same way as the Soviet Navy aims to use such data for SSM targeting.

The Soviet Army is heavily dependent on satellites for long-range communications. In 1984 the Soviets had about 115 satellites aloft, about 25% of which were dedicated to C^3 functions. By 1986 this had increased to about 130 satellites, half of which were used for C^3. Like all Soviet military communications systems, the satellite links are redundant and survivable, in part because of their large numbers.

Note: The trucks are Ural-375s, except for the mortar platoon's GAZ-66s. This diagram shows a battalion equipped with 1960s-70s-vintage radios, since replaced in many units.

The "civil" communication system is also used by the military, especially for long-haul secure communications. It is organised in 15 districts which closely match the military districts.

Electronic warfare

Electronic-warfare capability is found throughout the Soviet Army, not just in specialised units. It includes intercepting and analysing enemy radio and radar signals, jamming them and defeating enemy countermeasures. It

also aids in reconnaissance by compiling electronic order of battle and location data and providing target acquisition for artillery by the use of RDF units. Soviet electronic-warfare capability is extremely effective, according to many Western observers. Some NATO officers believe that Soviet jamming would reduce any future battlefield communications to the level of 1916, and that the US Army, heavily dependent upon radio communications for both its tactical and operational effectiveness, would suffer heavily. US Army exercises conducted under electronic warfare conditions tend to confirm this view.

Soviet electronic interception and direction-finding systems are linked to a variety of automatic data-processing equipment. Older models were large and had long processing times, but more modern, digital, versions are reportedly entering service.

Radioelectronic combat is the Soviet term for offensive electronic warfare. The strength and number of the front and army-level radioelectronic combat units show the emphasis the Soviets place on this type of warfare. Radioelectronic combat includes the use of RDF equipment to locate and identify enemy units, providing both intelligence and targeting data. It also includes signal intercept and intelligence work, studying and if possible decoding enemy messages. Jamming is used to put out of action any enemy radios or radars that cannot be destroyed. Specially trained personnel will be used for "spoofing": broadcasting to enemy units over their own networks to give spurious or confusing orders. The Soviet radioelectronic combat threat is a powerful one.

Soviet high-powered jammers can cover all the radio frequencies currently in US use. Large numbers have been produced and would be used for massive HF, VHF and UHF jamming operations. Though not sophisticated, they are rugged, reliable and effective. Capable of making the use of HF radios impossible, they can also severely limit VHF operations if proper electronic counter-countermeasures are not employed. The Soviets can intercept UHF signals – which are difficult to locate accurately because of their narrow beams – and then jam them.

The main jamming effort is directed at VHF FM tactical radios. A standard VHF jammer, truck or aircraft-mounted, might have 1,500–2,000W of power and a frequency range of 30–76MHz, and be capable of spot or barrage-jamming using a variety of directional antennae. In the barrage model a 2,000W unit could jam 20 VHF channels with 100W each. The inverse square law means that barrage jamming is often limited in range, however, putting a premium on the identification and location of enemy networks for spot jamming.

The US uses short-range, high-frequency radios to back up its multichannel VHF system. Although these transmitters normally use groundwave propagation as the principal means of communication, they also produce an equal skywave signal. This can be intercepted by Soviet radio directionfinders. US high-frequency stations are extremely vulnerable to jamming by high-power strategic jamming stations and jammers deployed with tactical forces. UHF systems are vulnerable to airborne jammers, which can achieve a line-of-sight path at much greater distances.

Airborne jamming platforms include specialised versions of the An-12 Cub, Mi-8 Hip and Mi-4 Hound capable of spot or barrage jamming at an effective range of over 200km. The Soviets can also use extensive chaff clouds to mask operations, as they did to conceal part of the airborne phase of the invasion of Czechoslovakia in 1968. Other Air Force aircraft – versions of the MiG-23 Flogger and Yak-28 Brewer – are used to jam air defence systems. Soviet use of high-powered airborne UHF jammers, limited in the 1970s, is increasing.

Supplementing these efforts, Soviet tactical aircraft have an anti-radiation missile capability in the AS-9 and AS-12 missiles. ARMs might also be carried by Hind-E.

Soviet concern over conventional weapons systems embodying emerging technologies has led to increased emphasis on electronic warfare. The Soviets are known to be working on technologies that could lead to a stand-off jammer effective against the millimetre-wave radar guidance projected for a number of Western deep battle systems.

The fact that the Soviets use the same HF, VHF and UHF frequency ranges as NATO for their own command and control communications systems makes them vulnerable to EW and limits their freedom to use jamming. At the same time, incidental interference from intermodulation and harmonics from active frequencies would be at least as troublesome as direct frequency "sharing".

This also puts a premium on Soviet ECCM. Techniques include deception and disinformation (such as setting up dummy networks as targets for enemy jamming and direction-finding); frequency spread; frequency diversity; directional antennae; limits on power; burst transmission; and, most important, the keeping of transmissions to a minimum.

Intelligence

Soviet specialised intelligence units perform the same basic functions as comparable NATO units, collecting and analysing data. This information is often collected by reconnaissance means, but it can also be obtained by the unit itself through PoW interrogations, observation or any number of other means. Airborne and special-forces companies are often attached to these units, giving them the ability to mount raids to collect vital information.

The chief of a Soviet formation's Second (*Razvedka*) Department not only performs the functions of an Anglo-American G2, but can also exercise operational

control over the formation's reconnaissance forces and assets. *Razvedka* is necessary for mobile, offensive warfare. If the Soviet commander knows what is on his flanks or what lies ahead, he can accept risks and is freer to act.

Afghanistan applications

It is probable that the invasion of Afghanistan was accompanied by activation of a number of operational and tactical control networks and the implementation of a deception plan. It is likely, for example, that the Soviets kept the radio networks of the motorised rifle divisions working in the Soviet Union for some time after they had crossed the border. Such tactics are known to have been practised in exercises in the Turkestan Military District in the months before the invasion.

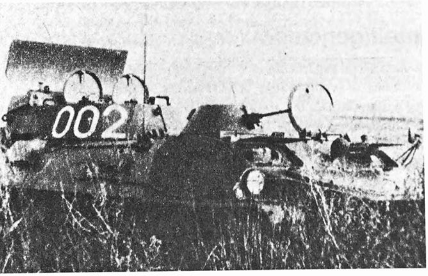
Afghanistan has proved to be a difficult war for the Soviet Army's electronics arms. The mountains block radio transmissions, requiring the use of helicopters or aircraft to relay messages.

Most of the radios in use in Afghanistan are older-generation equipment, although some new systems are appearing. Signals vans carrying old vacuum-tube systems are reported to have become so hot in summer as to be uninhabitable. The R-126 has proved of limited use for dismounted operations. R-126s and similar ex-Soviet systems are also used by the Resistance, which has difficulties with maintenance and spare parts, especially batteries. As a result, the Afghans prefer Western citizen's band systems. Radio interoperability between different Resistance groups approaches the impossible.

At a higher level, Soviet satellite ground terminals, signal repeater stations and aircraft navigation beacons have been set up throughout the country.

ELINT and radar have been extensively used in Afghanistan. In addition to adding to the intelligence picture and contributing to target acquisition, smaller surveillance radars have been co-located with AGS-17 grenade launchers to engage Afghans moving at night. RDF has been used in an effort to locate Resistance radios. Big Fred and Small Fred radars have been deployed to Afghanistan.

Big Fred radar vehicle with MT-LB-type 7.62mm machine gun turret.



Unit organisation

Signals battalion (motorised rifle division)
Total strength: 27 officers, 313 enlisted men, four BRDMs, 13 motorcycles, 52 trucks.
HQ and service company (nine officers, 45 enlisted men, one BRDM, 13 trucks)
CP company (six officers, 48 enlisted men, one BRDM, 16 trucks)
Radio communications company (six officers, 110 enlisted men, one BRDM, eight BTRs with radios, seven jeeps, seven GAZ-66 signals vans, five ZIL signals vans; radios include seven R-107, eight R-130, six medium-power HF/VHF, eight high-power HF/UHF, all vehicle-mounted)
Wire communication and radio relay company (six officers, 110 enlisted men, one BRDM, 14 GAZ-66 signals vans, seven ZIL signals vans, six trucks, two jeeps, 13 motorcycles, one medium-power HF/VHF, six R-401/405/409 radio relays, two communications centres) organised into one company HQ, two wire platoons, one radio relays platoon, one courier platoon, one operations platoon

Tank division signals battalions are identical, except that the radio and wire companies each have two more trucks and five more enlisted men.

Signals regiment (army)
Headquarters and services
Radio battalion
Wire communications battalion
Radio relay battalion

Signals brigade (front)
Headquarters and services
Command post
Two radio relay battalions
Wire communications battalion
Messenger unit

Radio and radar interception battalion (army)
Total strength: 60 officers, 585 enlisted men, 171 trucks.
HQ and services (15 officers, 80 enlisted men, 18 trucks)
Two radio interception companies (seven officers, 90 enlisted men, 31 trucks, 28 communications interception sets)
Radar direction-finding company (eight officers, 110 enlisted men, 39 trucks, 16 DF units of various types)
Radar interception and locating company (eight officers, 115 enlisted men, 26 trucks, 15 radar interception systems)
Processing and analysis company (15 officers, 100 enlisted men, 26 vehicles)

Area support element (formed for specific mission)

Radio and radar interception regiment (front)

Total strength: 139 officers, 1,400 enlisted men, 406 trucks.

HQ and service elements (20 officers, 100 enlisted men, 18 trucks)

Radio interception battalion (31 officers, 350 enlisted men, 111 trucks, 82 radio interception sets)

Radio direction-finding battalion (34 officers, 410 enlisted men, 135 trucks, 48 RDF sets)

Radar interception and location battalion (26 officers, 310 enlisted men, 70 trucks, 30 radar interception systems)

Radio relay interception company (8 officers, 100 enlisted men, 38 vehicles, 12 communications interception sets)

Processing and analysis company (20 officers, 130 enlisted men, 34 vehicles)

Area support element (composition dependent upon mission)

Radioelectronic combat battalion (army and front)

Total strength: 31 officers, 356 enlisted men, 137 trucks.

HQ and services (11 officers, 73 enlisted men, 12 trucks)

Two radio jamming companies (each of seven officers, 98 enlisted men, four radio interception sets, 12 radio jammers, three multi-channel jammers, 38 trucks)

One radar jamming company (six officers, 87 enlisted men, 49 trucks, 10 radar interception and location sets, four communications interception and location sets, 11 radar jammers)

One area support element (composition depends on mission)

Intelligence battalion (army-level)

Headquarters and service elements

Command post support element

Intelligence collection company

Interrogation company

Special operations company (attached)

A wide range of special-forces units can be attached.

Intelligence regiment (front-level)

Headquarters and service elements

Command post support element

Intelligence-collection battalion

Intelligence analysis and production company

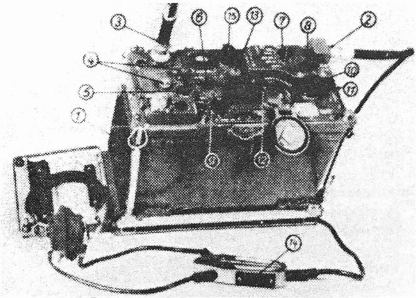
Two interrogation companies

One special operations company (attached)

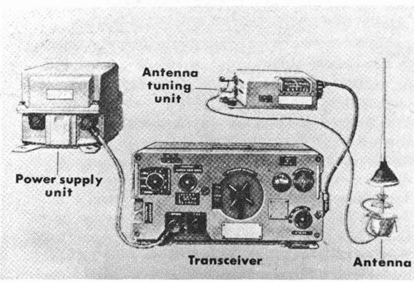
A wide range of special-forces units can be attached.

Radio designation	Frequency (MHz) and mode	Range (km)	Antenna	Use
R-105D & M	36–46.1 FM	4–6	whip/wire	Old, vehicle or pack
R-107	1–15FM	6–8	whip/wire	Vehicle or pack, company and above level. Replaced R-105, R-109, R-114
R-108D & M	28–36.5 FM	4–6	whip/wire	Artillery use, vehicle or pack
R-109D & M	21.5–28.5 FM	4–6	whip/wire	Air-defence use, vehicle or pack
R-112	2.8–4.99 AM	40–200	whip	Tanks, company commander and higher
R-113	20–23.375 FM	20	whip	Tanks & AFVs
R-114D & M	20–26 FM	4–6	whip/wire	Company & above, pack or vehicle
R-123 & 123M	20–51.5 FM	20	whip	Standard tank, APC, BMP, AFVs
R-126	48.5–51.5 FM	1–2	whip	Standard pack, MR platoon level
R-141/142	–	–	line	Mounted in ACRVs and command vehicles
R-154M2	1.5–12 AM, CW or MCW	–	–	Receives only, regiment/division level
R-173	FM	–	whip	Replacing R-123
R-254M	FM	3+	stub	Receives only, company level and below
R-255PP	FM	1–3	–	Receives only, three per airborne squad
R-311	1–15 AM, CW or MCW	–	any	Receives only, monitors fire-control and other networks
R-401/403	60–70 FM	40–50	twin yagi	Division and higher level. Vehicle mounted
R-405	320–420 FM	40–50	corner reflector	Division and higher level
R-104M	1.5–4.25 AM	30–50	whip	Regimental command networks
R-118/140	low HF, AM	600	2 whips	Regiments and above. GAZ-66 or ZIL-157-mounted
R-130	1.5–10.99 AM	20–50	whip	Replacing R-112/104 in tanks
R-148/158	37.0–51.95 FM	4–5	whip	Replacing R-126 in company networks (R-158 improved version)
R-350	–	–	–	Burst transmission, *Spetsnaz* use
R-392A	44–46 FM	2–3	whip	Replacing R-126 in platoon/company use
R-409	FM	50+	rectangular grid	Division and higher level, in ZIL-131 van. Cat's Eye array

R-107 radio.

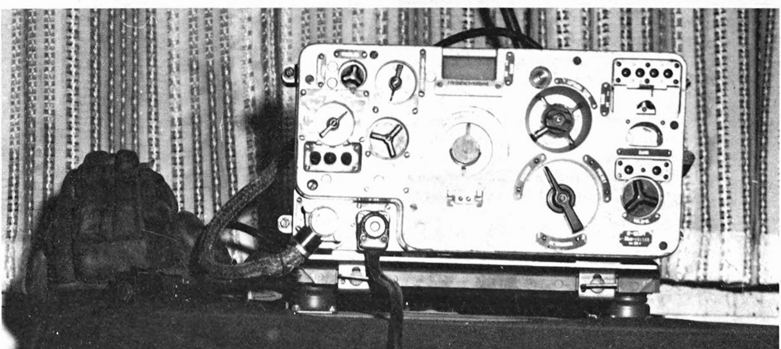


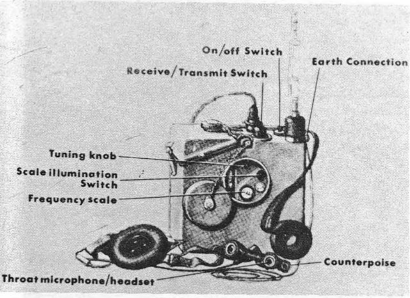
R-105D man-pack radio. *(Jane's Military Communications)*



R-113 tank radio.
(Jane's Military Communications)

R-123M AFV radio with tankman's helmet and microphone. *(US Army)*





R-126 radio, used at motorised rifle platoon level. *(Jane's Military Communications)*

R-254M radio receiver. *(David C. Isby)*

R-409 radio trucks with characteristic "grid" antennae, used for long-range communications and relay. *(US Department of Defence)*

Tactical radio networks

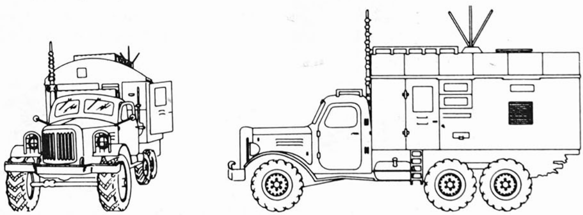
Units communicating	**Radios used**	**Distance**
Company-platoon	R-105, 107, 108, 123, 126	0.5km
Company-company	as above	3km
Battalion-company	R-105, 107, 123	5km
Regiment-battalion	as above	6km
Regiment-company	as above	8km
Regiment-regiment	as above	9km
Division-regiment	as above	7km
Division-division	as above	9km
Division-battalion	as above	12km

This shows the possible tactical networks in Soviet units. In two instances, regiment-to-company and division-to-battalion, it is possible to communicate directly and skip an echelon in transmitting signals, but otherwise a message must go through several hands to reach its ultimate recipient.

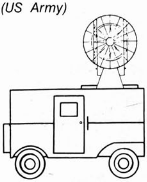
Electronic interception and location systems

Designation	Mission	Frequency range	Modes	Antenna	Receiver sensitivity	Power	Required time	Gain
SR-53-V (System A)	HF intercept	3–30MHz	AM, voice, CW, MCW	Rhombic	−105dBm	15kW	3hrs	15dBm
SR-52-V (System B)	VHF/UHF intercept	30–300MHz	FM, voice	LP	−110dBm	15kW	2hrs	10dBm
SR-51-V (System B-1)	VHF/UHF intercept	30–300MHz	FM, voice	Whip	−110dBm	5kW	15min	1dBm
SR-50-M (System C)	VHF/UHF intercept	30–450MHz	FM, voice	Whip	−110dBm	Battery	2min	1dBm
SR-54-V (System D)	relay intercept	30–300MHz	Voice, TTY	Dish or LP	−110dBm	10kW	1hr	40 or 15dBm
SR-20-V (System 1)	HF/DF	3–25MHz	AM	Adcock	−90dBm	15kW	5hrs	10dBm
SR-19-V (System 2)	VHF/DF	30–300MHz	FM, voice	Loop or Adcock	−90dBm	10kW	2hrs	0 or 10dBm
SR-25-V (System 3)	VHF/DF	30–300MHz	FM, voice	Loop	−90dBm	5kW	10min	0dBm
SB-20-V (System I)	Artillery and surveillance radar	50MHz–11GHz	–	Dish	−110dBm	15kW	1hr	40dBm
SM-21-V (System II)	Surveillance radar, intercept/DF	50MHz–10GHz	–	Dish	−110dBm	10kW	30min	40dBm

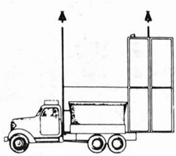
Designations are US Army training surrogates for NATO code names. Performance figures are approximate.



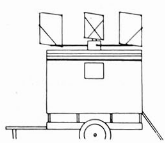
R-330 VHF/HF tactical communications jammer is typical of Soviet truck-mounted electronic warfare systems. The standard RDF station has an Adcock antenna in place of the three-pole type and the air communications jammer has a basket-type antenna. *(US Army)*



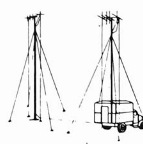
End Tray. *(EW Communications)*



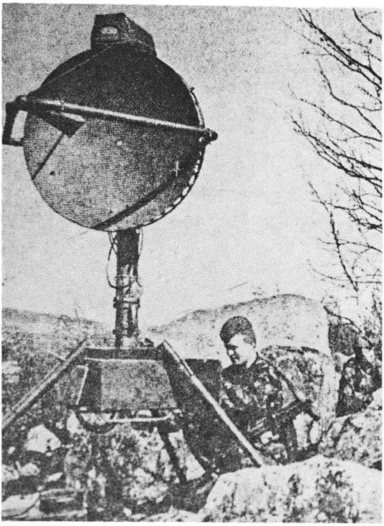
Home Talk PRL-4 precision ground-controlled approach radar. *(EW Communications)*



Loop Three HF DF system. *(EW Communications)*



R-401 Mercury Grass VHF communications system, frequently seen on SA-2 sites. *(EW Communications)*



Pole Dish ESM system. It can also be mounted on the back of a light truck. *(US Army)*

NRS-1 Pole Dish Jeep or man-portable tripod-mounted ELINT system with a 25km range. Information processing time is 5–7 minutes. Four per division.

SPZ and SPZM Man-portable radio and radar directionfinders respectively. Used by special operations forces. SPZ, with a loop antenna, was used by the North Vietnamese against US LRRPs.

Krug Strategic long-range HF/VHF intercept system with large circular array. Deployed in Cuba, Vietnam and elsewhere.

Loop series Series of HF DF sets.

Loop Three Trailer-mounted DF set.

Ring series Trailer-mounted DF sets.

Square Pick BB-127 DF equipment, vehicle mounted.

Thick Eight DF equipment. Fixed array.

Twin Box VHF DF system, used at division and army level.

Full House HF DF system, held at army level.

Fix-6 and Fix-8 VHF RDF systems. Other Fix systems include Fix-4 (Soviet designation PKV-45) and Fix-24 (HF DF).

Other ESM systems include **Big Ear**, **Soft Ball**, **Box Top** (HF DF), **R-308** (rhombic antenna), **R-305**, **R-363 (Spike-2)**, **R-316 (Spike Square)**.

Soviet Army radars

Ground surveillance radars

Long Eye Trailer-mounted battlefield surveillance radar with back-to-back dish antennae. Range 15–20km.

PSNR-1 Buzz Stand Tripod-mounted battlefield surveillance radar. I-band. Found in reconnaissance companies. Range 5–12km. Supplanted by PSNR-2.

GS-11 PSNR-2 Garpin Use: company-level, short-range surveillance; power 10kW; frequency 9,700MHz; max range 1.2km to detect personnel, 4.5km to detect vehicles; emplacement time 10min; mount: tripod; carried: manpack, two loads. Used by reconnaissance units: 12 per motorised rifle division, 9 (tank), 2 (airborne).

GS-12 Tall Mike Use: regimental-level surveillance; power 12kW; frequency 9,000MHz; range 3.5km to detect personnel, 12.0km to detect vehicles; emplacement time 5min; mounted on 11 BRM-1s per division.

Small Fred Mounted on PRP-3 (BMP M-1975). K-band. 36.2–37.0GHz. Detection range 20km; tracking range 7–12km; crew 5. Ten per division: three per target-acquisition battery, one per artillery battalion. Also has battlefield surveillance role.

Small Fred radar folded down into travelling position on a PRP-3 vehicle. There is a launch tube for illumination and target-marking projectiles. *(US Navy)*

Meteorological radars

End Tray (RMS-1) Trailer-mounted, used by all artillery and missile units. Parabolic dish antenna. Weight 7.5 tonnes; power 200kW; Soviet designation RMS-1. D-band. Five per division.

Bread Bin Trailer-mounted, used by FROG units. D-band. Range about 25km.

Stop Sign SVEL-10 meteorological radar.

Counterbattery radars

Small Yawn (ARSON-2P) I-band; mounted on AT-LM; dish antenna; used for mortar correction or counterbattery. Range 15–20km.

Pork Trough (SNAR-2) I-band. Mounted on AT-L or van. Used for both surveillance and counter-battery work. Surveillance range 40km; artillery detection range 9km. Uses "orange peel" antenna.

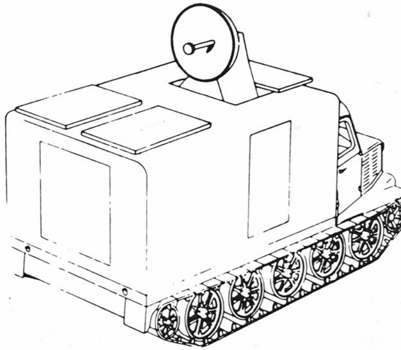
Pork Trough 2 (SNAR-6) Improved J-band version. Capable also of counter-mortar use. Mounted on AT-L or van.

Long Trough (SNAR-1) E-band; mounted on AT-L; parabolic cylinder antenna; used for counter-mortar role. Reportedly also mounted on a ZIL van.

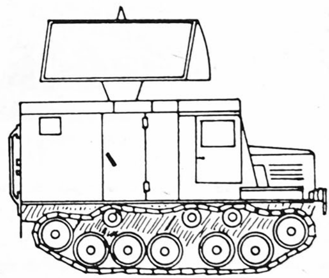
GS-13 Big Fred (SNAR-10) Mounted on MT-SON. Capabilities include counter-mortar and counter-battery. Range 20km; weight 11.5 tonnes; height 2.9m, antenna down; crew 4–6. Frequency: 40GHz. Power: 50kW+. CEP for mortar location: 45m at 10km, 65m at 20km; 150% these figures for artillery. May also have battlefield surveillance role, with 12–15km effective range. Two per division (including airborne).

In addition to these radars the Soviets have a full range of unattended sensors which include acoustic, disturbance, electromagnetic and seismic types. Their design may be based on US-built types captured in Vietnam.

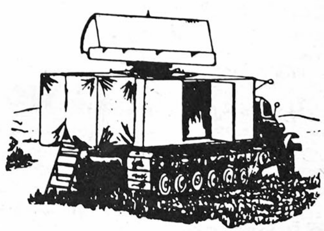
Soviet electronic-warfare battalions use a variety of jammers. These include the trailer-mounted Box Brick, truck-mounted Cheese Brick, truck-mounted High Brick with its power source in a trailer, truck-mounted Long Brick, trailer-mounted Mesh Brick, trailer-mounted Mound Brick used against aircraft radars, and Tub Brick and King Pin, also used against aircraft. Other jammers include R-330 (VHF/HF), R-378 (HF), R-388 (Tacan), R-934 (air-ground VHF), R-325 (HF), R-834 (radio).



Small Yawn.
(EW Communications)



Pork Trough. *(EW Communications)*



Long Trough. The ZIL van is incorrectly shown as a halftrack.

Yugoslavian Army MT-SON Big Fred radar vehicle with its antenna erected. The vehicle incorporates an NBC overpressure and filtration system, and a day/night image intensifier may be mounted on the turret.

Soviet C-cubed in action. A wide range of command and signal vans have been used in Afghanistan. Some are operated by the artillery, especially towed units. Other specialised vans include hospital and nuclear transport types, plus the VNO, VNBO-1, VNMI-1, VNRO-1 and VNBO-2 series of computer vans.

Chapter Twenty

Combat support vehicles

Mechanised warfare requires mechanised support. The Soviet Army has provided itself with a degree of logistic support that, while not as elaborate or effective as its US counterpart, is considered adequate for a short, victorious, mobile war.

The Soviet Army has access to over 350,000 trucks of all types, including those with their units and those loaned to other state agencies in peacetime under the *autokolomka* system. Annual production of trucks and buses exceeds 700,000 vehicles, and a large proportion of these would have military applications. The increasing production of trucks has enabled the Soviets to remedy many of the logistic shortcomings seen in the 1968 invasion of Czechoslovakia, and to decrease their reliance on railways for troop movement and supply.

The Soviet Army emerged from the Second World War still relying on horse transport and marching infantrymen. Only in the 1950s, after post-war reconstruction, did the Soviet Army receive a new generation of trucks and tractors to replace its wartime equipment and provide complete mechanisation. They were the GAZ-69, GAZ-63, ZIL-164, ZIL-151, ZIL-157, BAV, MAV, AT-P, AT-S, AT-L and AT-T. These vehicles established the basic characteristics of Soviet combat support vehicles: ruggedness, simplicity, a high degree of standardisation and interchangeability of parts, and good cross-country performance. Soviet engine technology lagged behind that of the vehicles, however, and many of them suffered from unreliable or underpowered engines. The ZIL-151 was particularly deficient, and was soon supplanted by the ZIL-157.

Reorganisation and rationalisation in the Soviet automotive industry in the early 1960s, along with the increasing production of the Warsaw Pact nations, allowed the Soviets to field a new generation of combat support vehicles including the UAZ-469, GAZ-66, Ural-375, ZIL-130, ZIL-131, KrAZ-255B, ZIL-135, MAZ-543, ATS-59, K-61, PTS-M and other improved vehicles. These featured improved engines and performance. Some, such as the GAZ-66 and Ural-375, were particularly successful, the latter's cross-country load-towing performance being so good that it was able to replace most of the artillery tractors in service. Other vehicles, such as the ZIL-130 and ZIL-131, were less successful. Engine, axle and transmission problems persisted, while vehicles such as the KrAZ-255B and MAZ-543 were criticised as being too heavy and technically complex.

Vehicles introduced in the late 1960s were intended to fill any gaps and remedy limitations in the preceding generation. The big MAZ-500–537 series of tank transporters gave the Soviet Army a powerful new operational capability in the late 1960s. Tank transporter regiments are seen as key contributors to operational mobility, and their movement to assembly areas is regarded as an indicator of a possible Soviet offensive. Total Western TVD transporter capacity is believed to amount to several divisions. Transmissions and axles improved, and high-horsepower diesel engines were introduced; the big MAZ-537 received a tank engine, for instance. Specialist vehicles such as fuel tankers were also emphasised.

In the 1970s Soviet truck improvements included the introduction of the KamAZ series, offering improved load carrying and cross-country capability. Today Soviet automotive technology has solved many of its problems, although it is still not at the level of Western nations or even that of some of its Warsaw Pact allies. Soviet trucks in service abroad show continuing limitations, including poor-quality components resulting in high breakdown rates and frequent overheating in warm climates. Nevertheless, the results of 60 years' emphasis on mechanising both Soviet society and its military arm have borne fruit.

The present Soviet military truck fleet, though still lagging behind that of the West in high technology, features a broad spectrum of vehicle types, more use of diesel power, high-mobility trailers to go with high-mobility trucks, and improved speed, power and fuel consumption. Three-axle high-mobility all-wheel-drive trucks like the Ural-4320, KamAZ-4310 and KrAZ-260 are being used in increasing numbers, as are powered trailers.

Specialised vehicles

The Soviet Army still uses large numbers of M-72 motorcycles, primarily for courier duties, both with and without sidecars. Based on the German BMW R-75, the M-72 has a maximum speed of 85km/h and a range of

300km, weighs 350kg and has a 22hp engine.

Other specialised vehicles use the chassis of standard trucks or artillery tractors whenever possible. These include rocket-launcher, radar, RDF, ATGM simulator, and other combat-support trucks. The ATZ-3-157K fuel-dispensing bowser carries 3,500 litres on a ZIL-157 chassis, and can deliver 300 litres/min through four hoses. The ATs-8-200 bulk fuel transport uses an MAZ-200 chassis to carry 8,000 litres. Three versions of the standard Ural-375 are the ATMZ-4.5-375, which can carry 4,500 litres of fuel or lubricant; the TZ-5, which carries 5,000 litres and five fuelling hoses; and the ATs-5-575 tank trucks, which also carries 5,000 litres. These replace the ATZ-34-131, a 3,400-litre fuel truck on a ZIL-131 chassis, the ATsM-4-157K tank truck carrying 4,040 litres of fuel or water, and the ATZ-2-157K fuel service truck, the last two being on ZIL-157 chassis. Light fuel haulage is carried out by the MZ-66 oil supply truck (820 litres) and the ATs-PT-1.7 1,700-litre tank trucks, both on the GAZ-66 chassis.

While there are liquid transport and POL versions of most modern Soviet trucks, dump trucks are normally only found at army and front-level engineer construction brigades. There are dump truck versions of the GAZ-53, ZIL-130, MAZ-200 and MAZ-500. The last-named is apparently the closest to a standard military model, although the other types will also be used.

There are tractor versions of a great many Soviet trucks: ZIL-164V, ZIL-130V, ZIL-157V, ZIL-131V, Ural-375V, Ural-377V, MAZ-200, MAZ-500, KrAZ-214V, KrAZ-258, Ural-4320, KamAZ-5410 and KrAZ-255. Other trucks, such as the ZIL-169 and MAZ-537, are intended primarily for use as tractors. Most tractor trucks can also be configured to carry bulk cargo.

The Pipeline Troops use a variety of modified trucks, the most significant reportedly being a modified ZIL-135 used for laying flexible pipelines while moving.

The Soviets are making more use of large trucks. 16-tonne 8 × 8 MAZ tractors have been used with 12 × 12 powered POL trailers. The MAZ 12 × 12 40-tonne transporter for the SS-20 missile is now apparently to be used as a load-carrier and pipeline-layer.

The Soviet Army does not emphasise special ambulance vehicles. In prolonged action, the UAZ-452 light ambulances would be overwhelmed by the numbers of wounded.

Trucks

Type	Weight (tonnes)	Max payload (tonnes)	Towed load (tonnes)	Cruise range (km)	Personnel	Engine type	HP	Length (m)
GAZ-69A, 0.5t*, 4 × 4	1.5	0.8	0.8	280	2 + 6	petrol	55	3.85
UAZ-469, 0.5t, 4 × 4	1.38	0.6	0.85	475	2 + 5	petrol	75	4.03
GAZ-66, 2t, 4 × 4	3.64	2.0	2.0	720	2 + 16	petrol	130	5.66
GAZ-63A, 2t, 4 × 4	3.28	2.0	1.6	350	2 + 12	petrol	70	5.53
ZIL-164, 4.5t, 4 × 4	4.1	4.5	4.5	410	3 + 14	petrol	100	6.70
ZIL-151, 4.5t, 4 × 4	5.58	4.5	3.6	600	3 + 16	petrol	95	6.93
ZIL-157, 4.5t, 6 × 6	5.45	4.5	3.6	580	3 + 14	petrol	104	6.68
ZIL-131, 3.5t, 6 × 6	6.7	5.0	4.5	425	3 + 24	petrol	150	6.90
Ural-375D, 4.5t, 6 × 6	8.4	5.0	10	600	3 + 24	petrol	175	7.35
ZIL-164, 4.5t, 4 × 2	4.1	4.5	4.5	410	3 + 14	petrol	100	6.70
Ural-4320, 5t, 6 × 6	8.4	5	7	1040	3 + 14	diesel	–	7.37
KrAZ-214, 7t, 6 × 6	12.3	7	10	530	3 + 14	diesel	205	8.53
KrAZ-255B, 7.5t, 6 × 6	12.18	8	10	650	3 + 14	diesel	265	8.65
MAZ-500, 7.5t, 6 × 6	6.4	7.5	10	698	3	diesel	180	7.31
ZIL-135, 10t, 8 × 8	10	12	18	650	4	petrol	180 × 2	9.27
MAZ-535, 16t, 8 × 8	19.25	7	15	650	4	diesel	375	8.78
MAZ-537, 16t, 8 × 8	22.5	15	75	650	4	diesel	525	9.13
MAV, 4 × 4 (amphibious)	1.98	0.5	0.5	320	5	petrol	55	5.06
BAV, 6 × 6 (amphibious)	7.4	2.5	–	530	2 + 25	petrol	110	9.54
KamAZ-5320, 12.5t, 6 × 6	16	12.5	13.5	650	2 + 30	diesel	205	7.82
KamAZ-5410, 13.5t, 6 × 4	14.2	13.5	13.5	650	2 + 30	diesel	205	8.10

* t = tonnes standard capacity. A new wave of truck designs emerged in the 1980s. These include: UAZ-3250, 1t weight, 4 × 4; ?, 1.5t, 4 × 4; GAZ-4301, 4.5t; ZIL-4331, 6t, payload 6/7t; MAZ-5336, 8t; KrAZ-250, 14t; MAZ-6302, 14t; KrAZ-260, 9t, 6 × 6, payload 9/30t, 300hp diesel; GAZ-3301, 2.5t, 4 × 4; KrAZ-360DM, 15t, 10 × 10, payload 11.63/8.0t; Ural-375N, 7t, 6 × 6, payload 7.7/?t; ZIL-169, tractor, payload 12t towed, 160hp diesel. Split payload figures indicate on-board/towed.

For such cases the Soviets appear to rely on standard trucks, with their uncomfortable suspension.

The KamAZ trucks, from the Kama River plant, are a substantial addition to the Soviet Army's combat support strength and contributed to the great improvement in Soviet logistics capability that occurred in the 1970s. The Kama River plant, built with imported Western technology, is capable of producing 150,000 trucks and 250,000 diesel engines a year. While KamAZ trucks are delivered to both Army and civilian users in the Soviet Union, they can all be easily added to the armed forces, as indeed can any Soviet vehicle. KamAZ trucks were used in the 1979 invasion of Afghanistan and throughout the subsequent war.

A new family of Soviet tracked transporters is entering service. The MT-S is the new medium tractor, intended to replace the ATS-59 series. The new heavy tractor, the MT-T, emerged in the early 1980s. It used suspension elements from the T-64 and the V-46-4 12-cylinder diesel engine derived from the T-72 tank. It is probably intended to replace the AT-T tractor. The PTS-2, based on the MT-T chassis, is a replacement for the PTS-M amphibian. The GT-MU is a light armoured transporter, designed as a follow-on to the GT-SM. The MT-S is the basis of the vehicles associated with the SA-11 system, the MT-T that of those associated with the SA-12. The DT-20 and similar DT-20B are Arctic transporters with a driven trailer. The PTS-2 is an improved PTS with an armoured cab.

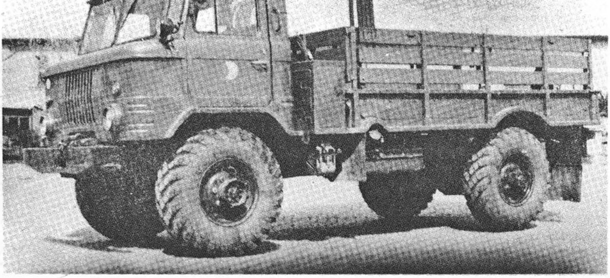
Soviet trucks are designated by the plant from which they originated: GAZ = *Gorki Auto Zavod* (factory), MAZ = Minsk, ZIL = *Zavod Imeni Likatshov* (factory named for Likatshov), YaAZ = Yaroslavl, KrAZ = Kremenchug, Ural = Shodino (in the Urals). Amphibious means that the vehicle can swim by jets or tracks. The MAV and BAV have water speeds of 9 and 10km/h respectively, propeller-powered. The tracked K-61 and PTS-M ferries use twin propellers to attain speeds of 10 and 15km/h respectively. The GT-S and GT-T use hydrostatic propulsion. The more modern Soviet trucks all have centralised air pressure control for their tyres. The Ural-375D series is currently the standard Soviet Army truck, although the ZIL-157, which it replaced, still continues in service, as does the earlier ZIL-151. The Ural-4320 and KamAZ-4310 are supplementing the Ural-375D, increasing lift capacity by up to 60%. Heavy hauling is done by the MAZ series and the ZIL-135, with its excellent cross-country load-carrying capability. The GAZ-66 is the standard light truck, while the GAZ-69 and the newer UAZ-469 are the Soviet equivalents of the jeep. The LuAZ-967M was designed as a light tactical ambulance and AT-4 carrier.

In the tables in this section all weights are given in tonnes, and are for hard surface. They may be reduced by up to 50% for cross-country travel. Cruise range is also on hard surface roads. "Personnel" indicates crew in cab *plus* passengers, if any. Trucks may be overloaded with both personnel and payload. While this will burn them out in the long run, it gives the Soviets a significant logistic "surge" capability. Standard chassis are also used for almost all specialised combat support roles, from tank transporting to engineer work.

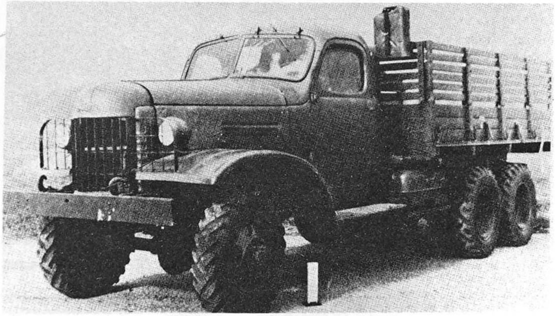
Soviet trucks are equipped with a wide variety of trailers, from the small, two-wheeled versions used by the GAZ-69 to the massive tank and missile carriers pulled by the MAZ series.

GAZ-69 light truck. *(US Army)*

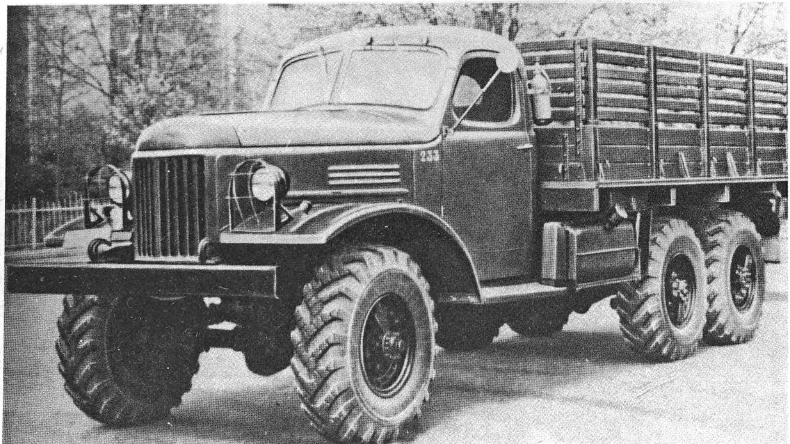
UAZ-469B. *(v/o Autoexport)*



GAZ-66 truck of the Czech Army. *(US Department of Defence, via Virginia Mulholland)*

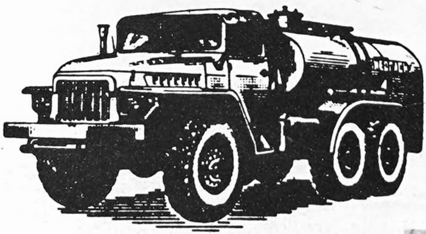


ZIL-151. *(US Department of Defence, via Virginia Mulholland)*



ZIL-157K. *(v/o Autoexport)*

ZIL-131. *(v/o Autoexport)*

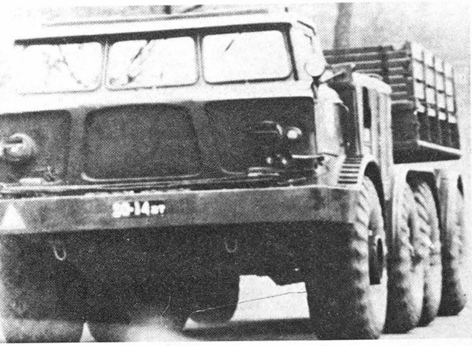


The TZ-5, ATs-5-375 and ATsG-375, three 5,000-litre capacity tank versions of the Ural-375, are standard POL movers.

Ural-4320 6 × 6 4.5-tonne truck, follow-on to the URAL-375D as a standard vehicle.

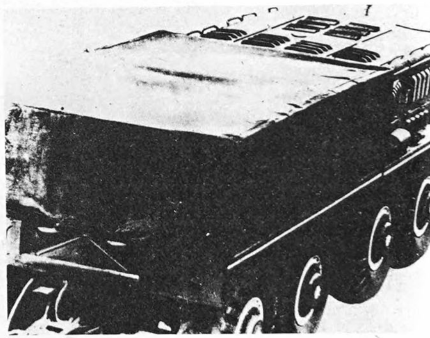
KrAZ-214s towing 130mm M-46s. *(Egyptian Army)*

KrAZ-255B truck carrying a PMP pontoon section. There is one such bow section in each half-set of PMP bridging, in addition to the normal boat-shaped folding centre sections. *(Defence Intelligence Agency, via Virginia Mulholland)*

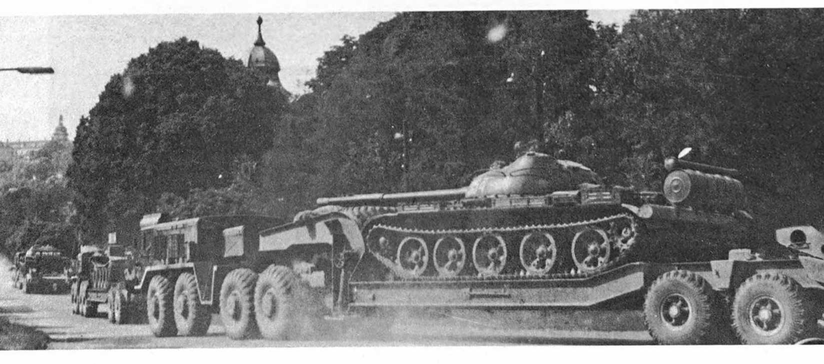


ZIL-135 truck. *(US Department of Defence, via Virginia Mulholland)*

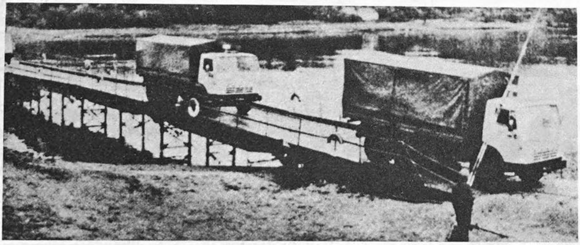
MAZ-535. *(US Army)*



Below MAZ-537s tow tank-transporter trailers carrying T-62s. The increased use of tank transporters has become a key element in Soviet operational mobility, putting forces from the western military districts within easy reach of Eastern Europe. *(US Department of Defence)*



MAV (GAZ-46) amphibious light truck of the Polish Army. The suspension is similar to that of the GAZ-69. *(US Army)*

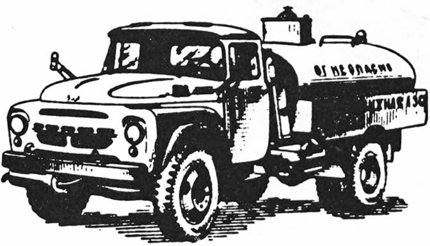


KamAZ-5320 trucks serving with Group of Soviet Forces Germany. *(US Department of Defence)*

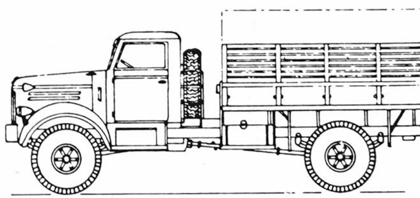
KamAZ-5410. *(US Department of Defence)*

Trucks and vehicles of secondary importance

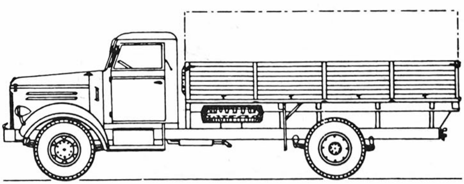
Type	Weight (tonnes)	Max payload (tonnes)	Towed load (tonnes)	Cruise range (km)	Personnel	Engine type	HP	Length (m)
GAZ-51, 1.5t, 4 × 2	2.7	2.5	3.5	450	2 + 10	petrol	70	5.71
GAZ-53, 3t, 4 × 2	3.25	4.0	4.0	375	2 + 10	petrol	115	6.4
Ural-355M, 3.5t, 4 × 2	3.4	3.5	5.0	450	2 + 12	petrol	95	6.3
ZIL-150, 3.5t, 4 × 2	3.9	4.0	4.5	405	2 + 14	petrol	90	6.7
ZIL-130, 4.0t, 4 × 2	4.2	5.5	6.4	475	2 + 14	petrol	170	6.67
MAZ-502, 4.0t, 4 × 4	4.48	4.0	9.5	590	3 + 16	petrol	135	7.15
MAZ-200, 5.0t, 4 × 2	6.75	7.0	9.5	500	3 + 16	diesel	120	7.62
MAZ-500, 7.5t, 4 × 2	6.5	7.5	12.0	900	3 + 14	diesel	180	7.33
Ural-377, 7.5t, 6 × 4	6.64	8.0	10.5	500	3 + 16	petrol	175	7.86
ZIL-133, 8.0t, 6 × 4	6.2	8.0	9.5	520	3 + 24	petrol	220	9.0
KrAZ-219, 10.0t, 6 × 4	11.3	12.0	15.0	750	3 + 28	diesel	180	9.66
YaAZ-210, 10.0t, 6 × 4	11.3	12.0	15.0	820	3 + 28	diesel	165	9.66
KrAZ-257, 12.0t, 6 × 4	11.13	12.0	16.6	1000	3 + 28	diesel	240	9.66
MAZ-543, 16t, 8 × 8	17.5	17.5	50	500	4	diesel	–	11.7
LuAZ-967M, 0.5t, 4 × 4	0.93	0.42	0.3	411	2 + 1	petrol	37	3.682
LuAZ-969, 0.5t, 4 × 4	0.82	0.40	0.35	400	2 + 1	petrol	27	3.2
UAZ-452, 0.8t, 4 × 4	1.67	0.80	0.85	430	2 + 4	petrol	72	4.46
KamAZ-5320, 0.8t, 6 × 4	7.24	8.0	11.5	650	2 + 24	diesel	180	8.3
KamAZ-4310, 6.0t, 6 × 6	8.0	6.0	12.0	650	2 + 18	diesel	210	7.6



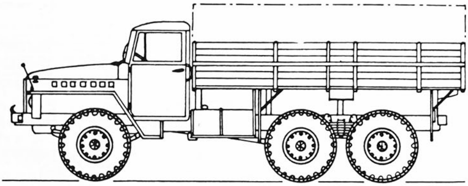
PAZS-3152, based on a ZIL-130 chassis, has a capacity of 4,500 litres of fuel and 200 litres of oil. Fuel is dispensed at a rate of 40 litres/min.



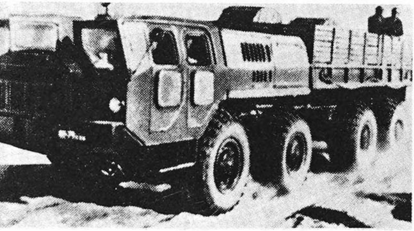
MAZ-502 4,000kg truck. *(Jane's)*



MAZ-200 5,000kg truck. *(Jane's)*



Ural-377 7,500kg truck. *(Jane's)*



MAZ-543 configured for carrying bulk cargo. *(Defence Intelligence Agency, via Virginia Mulholland)*

Production dates

Soviet equipment policies ensure that their armed forces will field a variety of motor transport that is as bewildering as it is fascinating. The Soviets rely on mobilised civilian motor transport for units throughout the Soviet Union, and a full-scale call-up will probably result in vehicles of considerable antiquity entering military service. When new models of trucks appear, they do not totally replace older models. The requirements of both the Soviet military and the Soviet economy for trucks is almost insatiable. On the other hand, the poor mechanical reliability of many Soviet motor vehicles, particularly the earlier models, and the poor maintenance many civilian-operated trucks are known to receive mean that the attrition rate of vehicles, especially those in civilian hands in peacetime, is likely to be considerable. This situation cannot be helped by the fact that service support is increasingly being placed on a "combined arms" basis.

Combat support vehicles and the supply base

The effectiveness of Soviet combat support vehicles must be evaluated in the context of their logistic system (as outlined on pages 92–95). Whenever rail transport is impractical – which will be most of the time in an armoured offensive into enemy territory – it will fall on the combat support vehicles to carry supplies forward. If the combat support vehicles fail in this task, all the tanks and BMPs might as well have stayed at home. The size of the task can be judged from a breakdown of a Soviet army supply base. Commanded by the army-level deputy commander for rear services ("chief of the rear"), along with the deputy commander for technical matters and deputy commander for armaments, it includes the following installations, with their distance behind the line of departure in offensive operations shown in parentheses:

One or two ammunition depots (50–100km)
One rocket and missile ammunition depot (50–100km)
One chemical depot and repair shop (75–150km)
One engineer depot and repair shop (75–150km)
One signals depot and repair shop (75–150km)
One mobile artillery repair shop (75–150km)
Two rations depots (75–150km)
Two field bakeries and flour mills (75–150km)
Two or three POL depots (50–100km)
One artillery and small arms depot/repair shop (50–100km)
Two tank depot and repair shops (75–150km)
Two vehicle depot and repair shops (75–150km)
Four to six bath and laundry units (75–150km)
One recovery and salvage depot (75–150km)
One clothing and equipment depot/repair shop (75–150km)

Also depending on the army's combat support vehicle resources are:

One medical depot (75–150km)
One mobile therapeutic hospital (75–150km) (from front level)
One to four mobile army surgical hospitals (10–14km) (from front level)
One KGB nuclear weapons depot (75–150km).

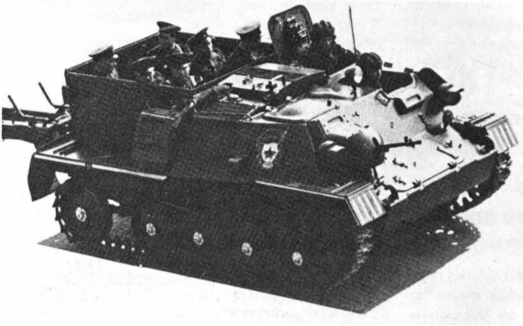
The front-level supply base is even more elaborate and further from the line of departure. Similar to that found at army level, it includes:

One chemical depot/repair shop
One signals depot/repair shop
Two replacement centres

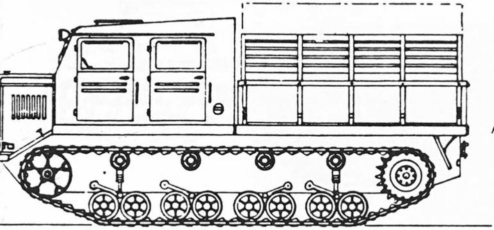
One to three motor transport regiments
One or two rocket and missile depots
Two or three rations depots
Two material recovery battalions
One to four ammunition depots
One artillery and small arms depot/repair shop
Two tank depot/repair shops
Four mobile tank repair battalions
Two vehicle depot/repair shops
Two equipment depot/repair shops
Two to five bath and laundry units
Two or three bakeries and flour mills
Also drawing on front vehicle resources are:
Two or three aviation supply stations
One general hospital
One convalescent hospital
One medical replacement company
Two medical depots (all the above under the front medical directorate)
One to three KGB nuclear weapons depots.

Artillery tractors, tracked prime movers, and amphibious ferries

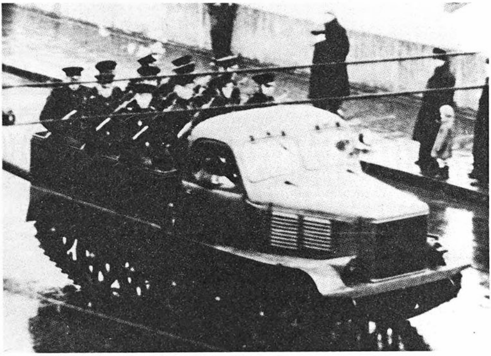
Type	Weight (tonnes)	Max payload (tonnes)	Towed load (tonnes)	Cruise range (km)	Personnel	Engine type	HP	Length (m)
AT-PM	5	2	3.7	360	3 + 6	petrol	110	4.05
AT-S	12	3	16	380	3 + 12	diesel	250	5.87
AT-LM	8	2.7	5	320	2 + 12	diesel	130	5.12
ATS-59	13	3	14	350	2 + 14	diesel	375	6.3
ATS-59G (M-1972)	13.8	4	18	500	2 + 14	diesel	415	6.1
AT-T	20	5	25	700	2 + 14	diesel	415	6.99
MT-L	8.5	4.2	7	500	2 + 17	diesel	240	6.36
GT-S (amphibious)	4.65	1	2	725	2 + 9	petrol	85	4.9
GT-T (amphibious)	8.2	2	4	500	3 + 10	diesel	200	6.5
GT-SM (amphibious)	4.8	1	2	300	2 + 10	petrol	115	5.36
K-61 (amphibious)	9.55	3/5	8	530	3 + 32	diesel	135	9.15
PTS-M (amphibious)	17.7	5/10	8	300	3 + 70	diesel	350	11.5
GT-MU (amphibious) (armour)	4.8	1.2	1.2	–	2 + 10	petrol	115	5.1
MT-S	23.5	10.2	25+ ?	–	4	diesel	710	7.8
MT-T	25	12	12	–	15 + 18	diesel	710	8.6
DT-20 (Arctic)	27	4	16	–	–	diesel	710	–
PTS-2 (amphibious) (armour)	–	5/10	16+ ?	–	–	diesel	710	11.5



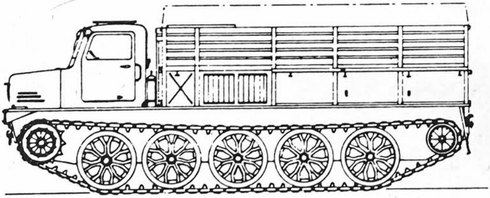
AT-PM tractor. *(US Army)*



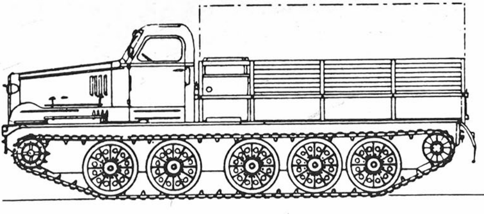
AT-S medium artillery tractor. *(Jane's)*



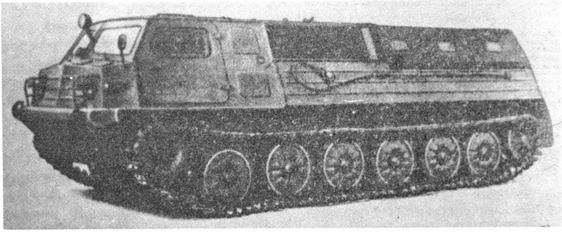
AT-LM light tractor. *(US Army)*



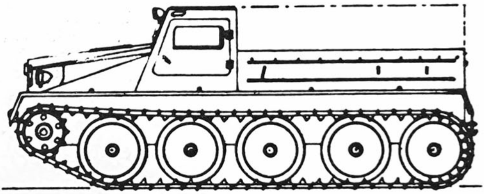
ATS-59 medium artillery tractor. *(Jane's)*



AT-T heavy artillery tractor. *(Jane's)*

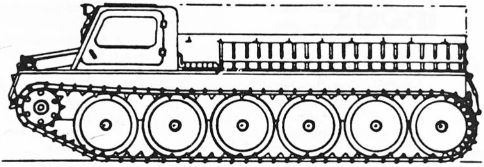


The MT-L unarmoured version of the MT-LB was built in only limited numbers.

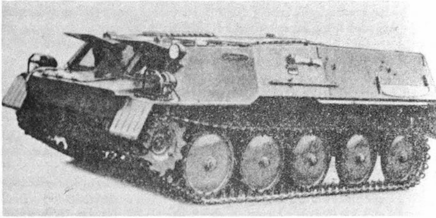


GT-S tractor. *(Jane's)*

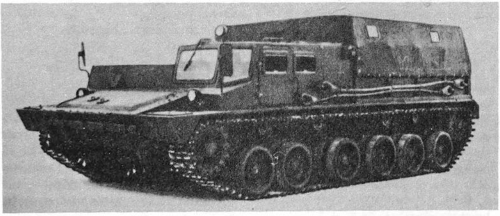
GT-T tractor being used as an APC by KGB Border Troops. *(Chris Foss)*



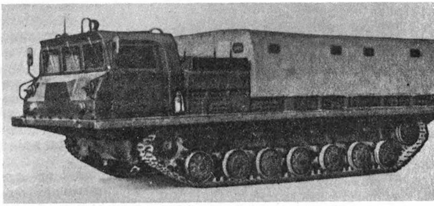
GT-SM tractor. *(Jane's)*



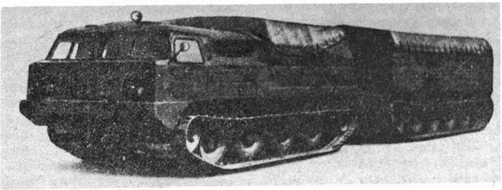
GT-MU armoured tractor. The armour is believed to be 7mm steel, similar to that of the PTS-2 cab. Structure is thought to be of either electro-slag remelted steel (like the BMP) or welded TMT rolled steel (like the BTR-60).



MT-S medium tractor.



MT-T heavy tractor.



DT-20 tractor and driven trailer.

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Italicised numerals refer to captions

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Illustrated with over 450 photographs, maps and drawings, *Weapons and Tactics of the Soviet Army* is a combination of expert comment and detailed analysis. An army is more than mere numbers of divisions, and performance figures alone cannot tell the full story of a weapon's effectiveness. *Weapons and Tactics of the Soviet Army* puts units and systems into their larger perspective to produce an unrivalled assessment of the fighting power of the world's largest army.

David C. Isby is an attorney who has worked as a consultant on national security and foreign policy issues, as a legislative assistant in the US Congress, as a lawyer dealing primarily with international affairs and litigation, and as an editor and writer for *Strategy & Tactics* magazine. He is the author of *Armies of NATO's Central Front*, published by Jane's, and *Russia's War in Afghanistan*. He has also designed 19 conflict-simulation games and is a frequent contributor to *Jane's Defence Weekly*.

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